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BRIEFLY TOLD.

SIXTH ANNUAL MEETING, KANSAS GAS, WATER AND ELECTRIC LIGHT ASSOCIATION.—"The sixth annual meeting of the Kansas Gas, Water and Electric Light Association, which was held in Topeka, Kas., the 19th and 20th days of last month, was creditable in every sense. The attendance was large and representative, the names of 16 new members were placed on the rolls, the weather was on its fair behavior, and the technical proceedings were interesting and in no sense on the advertising or personal order. The one shade to the light of the assembly was the knowledge that death had claimed, in the interval of the meetings, Mr. W. G. Seabury, of Pittsburg, Kas., Past-President of the Association. The constitution was amended so as to admit street railway operators to active membership, and to remove the territorial restriction hitherto applying to applicants. The following papers were read:

"'City Water Supplies;' by Prof. E. H. S. Bailey, Kansas University.

"'Electric Distribution System for Smaller Cities and Towns;' by Prof. R. M. Freeman, Kansas University.

"'Franchises;' by Mr. John C. Nicholson, Newton, Kas.

"'Single-Phase Motors as Means of Increasing Central Station Earnings;' by Mr. C. C. Bissell, St. Louis, Mo.

"'Better Occupation of Our Investments;' by Mr. C. R. Maunsell, Topeka, Kas.

"'Co-operation;' an address by Mr. Joab Mulvane, Topeka, Kas.

"The officers elected were:

"*President*—Mr. C. R. Maunsell, Topeka.

"*First Vice-President*—Mr. R. C. Johnston, Lawrence.

"*Second Vice President*—Mr. John C. Nicholson, Newton.

"*Third Vice-President*—Mr. A. T. Rodgers, Beloit.

"*Secretary and Treasurer*—Mr. Jas. D. Nicholson, Newton.

"*Executive Committee*—Messrs. Jesse Shaw, E. S. Springer and J. H. Fuller.

"The next meeting will be held at Leavenworth, Kas., October 18th and 19th, 1904. The Committee on Entertainment, whose successful efforts were thoroughly appreciated by those in attendance (whether guests or members), had arranged for a trolley ride to different points of interest, the newly-elected Superintendent of the Topeka Railway Company seeing to it that excellent transportation was afforded—he is too bashful to permit the reprinting of his name. The Association visited the great shops of the Santa Fé Railroad—their equipment is perfect—and also inspected the local light and power stations of Topeka, which are claimed to be as complete as any others that can be found in the West. The meeting was a most successful one, and its indications are that the Association cannot help to go on to greater usefulness.—K. C. M."

A DESPATCH from Providence, R. I., dated noon, the 4th inst., reports the destruction by fire of the purifying house, West Station, Providence Gas Company. No lives were lost, and the gas supply of the city was not interfered with.

LIBRARY OF CONGRESS. DEC. 7 1903 SMITHSONIAN DEPOSIT.

Correspondence

[The JOURNAL is not responsible for the opinions expressed by correspondents.]

Mr. James Somerville Dissents.

ENGINEER'S OFFICE, INDIANAPOLIS GAS COMPANY,
INDIANAPOLIS, IND., Nov. 30, 1903.

To the Editors AMERICAN GAS LIGHT JOURNAL: I expected someone to reply to Mr. F. Egner's extraordinary criticism on Mr. A. G. Glasgow's paper in your issue of the 23d inst. I see in your last issue he again returns to the subject. He charges Mr. Glasgow with advocating the enrichment of gas and of selling a high candle power. As I read the paper I cannot find the slightest intimation that he does anything of the kind. He does advocate, however, that in selling a low grade gas the consumer should have such a reduction in price that would compensate him for the loss of energy in the gas, and shows, I think conclusively, that in one case where the consumers of the South Metropolitan Gas Company have not received an equivalent reduction, but in fact have been defrauded. This is a serious charge and it would be interesting to see it refuted. As Mr. Glasgow well says, and I wish those advocates of low grade or fuel gas would bear it in mind, "Gas *as gas* has no value to the consumers. Its whole value depends upon its ability to convey and develop useful energy, and that gas is cheapest which provides the maximum energy at the minimum price." Mr. Egner evidently thinks that a gas containing 300 heat units is just as valuable to the consumer as one containing 670.

Yours very truly, JAMES SOMERVILLE.

Mr. F. Egner on Certain Features in President Miller's Address.

WASHINGTON, D. C., Dec. 1, 1903.

To the Editors AMERICAN GAS LIGHT JOURNAL: Mr. W. A. Aldrich was not the only man somewhat disappointed in the Presidential address delivered by Mr. Alten S. Miller at the recent (or 31st annual) meeting of the American Gas Light Association. It is not my purpose to go over the whole of that document at this time, but having been prevented by an accident from being present at that meeting, I too, "As a member of the American Gas Light Association," wish to call particular attention of the members to at least one of the recommendations of the Association's late President. It seems that others as well the writer looked forward to something above the average in the way of the annual address, remembering Mr. Miller's ready responses, when he is called upon to speak on any subject whatever, which may be up for discussion at any of our meetings at which he is present.

It certainly is not a lack of acumen in Mr. Miller's nature that is responsible for his want of having made more of his opportunity which the position as President of the American Gas Light Association for the past term gave him. His recommendation concerning the preparation and subsequent discussion of papers for the Association, it may be hoped was not adopted, though by reason of the ill advised policy of the Association, by which those who could not be present cannot know what really was going on, until the officials have had time to prepare and get out the "Year Book," the writer does not know.

Mr. Miller, in effect, recommended that the "Proceedings" shall partake still more of the cut-and-dried order, of which there is too much already to make attendance at them more of an object than it has become If that recommendation has prevailed, then, first, the apotheosis of a certain part, and so on to the end.

There are, of course, two, and even more than two, ways of looking at every question, and notwithstanding my remarks in the preceding sentence, I do not wish to imply any improper motive to Mr. Miller's recommendation to have the Council not only select the subjects for the papers to be read, but to prearrange for their discussions as well. I think that the Association has gone about as far in that direction as it is safe to go, if its usefulness is to be conserved. Much of the spice and piquancy which add so greatly to the attractiveness of the discussions, and not always but sometimes rescue an uninteresting paper, will be cut out if that recommendation is favorably acted upon; and instead of spending from $50 to $100 to attend a meeting, it will be more comfortable and certainly less expensive for a member to stay at home and read the "prearranged" matter at his leisure. If it is an object to save time and to provide for an intelligent discussion of any paper, not springing as it were a new subject on the writer of a paper, as happened "yours truly" by "prearrangement," but of which he had not been given previous knowledge, not so very long ago, then let not only all papers be printed and sent out to the members in ample time for all who wish to prepare themselves to take part in the discussion, but also let it be a positive rule that no paper shall be read at any meeting unless so treated. In connection with this subject I would earnestly recommend you, Messrs. Editors, if you think well of it, to republish the article on "The Procednre at Institution Meetings," which appeared on page 341 of the *Journal of Gas Lighting*, of the 10th ult., and which said *Journal* itself has taken from the columns of the *Electrical Review*. Hoping that you will do this in the interest of "whom it may concern," I shall forbear quoting from that excellent and pertinent as well as timely article. Very respectfully, FREDERIC EGNER.

[ABSTRACT.—CONTINUED FROM PAGE 845.]

PROCEEDINGS, THIRTY-FIRST ANNUAL MEETING, AMERIGAN GAS LIGHT ASSOCIATION.

HELD IN DETROIT, MICH., OCTOBER 21, 22 AND 23, 1903.

FIRST DAY—MORNING SESSION.

On motion, the reports from other special committees were postponed, and the President called for the

RERORT OF COMMITTEE ON NOMINATION OF OFFICERS,

which was read by Mr. E. G. Pratt, of Milwaukee, Wis., as follows:

DETROIT, MICH., Oct. 22, 1903.

To the American Gas Light Association—Gentlemen: We present the following nominations for officers and members of the Council for the ensuing year:

President—Rollin Norris, Philadelphia, Pa.
First Vice-President—Edward G. Cowdery, St. Louis, Mo.
Second Vice-President—Charles F. Prichard, Lynn, Mass.
Third Vice-President—Charles R. Faben, Jr., Toledo, O.
Secretary and Treasurer—Alfred E. Forstall, Montclair, N. J.
Members of Council—(Terms expire 1905)—A. G. Glasgow, London, England; John Williamson, Chicago; Wm. A. Wood, Boston; Walton Clark, Philadelphia.

Respectfully submitted,
E. G. PRATT,
H. L. DOHERTY,
W. C. MORRIS,
WM. E. MCKAY,
} Committee.

ELECTION OF OFFICERS.

On motion, the report was accepted, and Mr. Pratt was directed to cast the ballot of the Association in favor of the election to office of the gentlemen named. The tellers (Messrs. T. D. Miller and A. H. Barret) having reported that the ballot had been cast and counted, pursuant to instructions, President-elect Norris made suitable response in acknowledging his promotion, as did Vice-Presidents Cowdery and Prichard. Mr. Faben was not present.

The President called Vice-President Norris to the Chair, and the former thereupon read his

INAUGURAL ADDRESS.

[For the text of President Miller's Address, see JOURNAL, Nov. 2, p 682.]

COMMITTEE ON PRESIDENT'S ADDRESS.

The Chairman said, as it was customary to refer the address to a committee for consideration and report, he would appoint as such committee Messrs. Walton Clark, Irvin Butterworth and W. C. Morris.

The President then called for the

REPORT OF THE COMMITTEE ON ELECTROLYSIS,

which report was not then presented.

Mr. Rollin Norris read the

REPORT OF THE COMMITTEE ON MUNICIPALIZATION,

which, on motion of Mr. R. B. Brown, was accepted and the committee was continued for another year.

Mr. Rollin Norris, speaking for the

REPORT OF THE RESEARCH COMMITTEE,

made a verbal report, the gist of which was to the effect that the committee had tried in several directions. That at the next meeting he trusted there would be a number of reports from the various companies whom he had interested in an inquiry on the details of purification. He named as special points the depth of the boxes and the question of air admission. The consumers' meter question was also being investigated, especially the difference between the different meters of the various makers, some of which seemed to be more efficient than others.

Mr. C. J. R. Humphreys made the formal motion to accept the report and to continue the committee, both of which suggestions were adopted.

The President then appointed as the

COMMITTEE ON NEXT MEETING PLACE.

Messrs. C. J. R. Humphreys, Edward G. Cowdery and Walton Clark. He also named Messrs. W. R. Beal, Geo. G. Ramsdell and Edward G. Pratt as the

COMMITTEE ON AWARD OF BEAL MEDAL.

The President invited the members of any "foreign societies" that might be present to take part in the proceedings, after which the Secretary read a number of

LETTERS AND TELEGRAMS OF REGRET

from the forwarders signifying their belief that the meeting would be a successful one, and regretting their inability to take part therein.

The President announced that, as the time prior to adjournment was getting too short to permit of the taking up of a regular paper, if there were no objection, a

DIP INTO THE QUESTION-BOX

would be made. The first query was:

> "What is an effective and economical method of stopping the fluctuations of gas in the system of piping to which a gas engine is connected?"

Mr. C. H. Graf said he had found that, when the load was "fairly constant," an effectual method was to put a stopcock on the meter side of the gas bag and to "choke down the supply so that the bag fills slowly, instead of all at once." In this way he had "reduced the fluctuation from 6 tenths to 2-tenths, which variation did not show on an open flame or a Welsbach burner." He had also used an old meter case with fair success, but that neither scheme would work in all cases.

Mr. Robert M Searle stated that he had used two bags tandem with a controlling cock before the first bag, but did not state his success.

Mr. Wm. J. Serrill said that in Philadelphia a diaphragm governor was used with fair success.

Mr. James Somerville said he had used an old meter, without the index, with some success. It cured the trouble, but he "did not see why." However, it did not cost much, but did the business.

Mr. J. B. Klumpp said that fair success had been obtained by putting in a tank and bag tandem. He stated that an appliance was in the trade which worked with good results, and concluded by saying: "In all cases reduced vibration in the main is obtained by having a large sized pipe connecting the tank or bag with the engine and throttling the gas at the inlet to the tank or bag."

Mr. R L. Kenah, Jr., said they were using a diaphragm regulator, and in connection with it a tank or gas reservoir according to the plan suggested. He drew attention to the fact that when a tank is used the engine takes up its supply of gas by suction from the tank, and even a length of large pipe would serve.

The Secretary suggested that in using the method by throttling, it was important not to throttle so much as to overdo, thus cutting down the supply and reducing the power of the engine. He recounted an instance and explained that he obtained success by putting in "a floating governor with a sufficient gas capacity for one stroke." He said he had received a description and sketch of an anti-fluctuator which seemed to him to be some special form of a diaphragm governor, which had been sent with sketches by Mr. E. C. White, of Long Branch, N. J. He then read some answers received by mail.

Mr. G. R. Fickert, Supt. of the shops of the S. Bernstein Company, sent a plan, submitted by the Company, more remarkable for ingenuity than for practical usefulness.

Another letter was received from the Bayles Company, setting forth its solution.

Mr. Egner wrote that he had cured the trouble by putting in "an old meter prover between the gas engines and the house pipes," in the building of the Laclede Company, St. Louis.

The next question in the box, which was one of great interest scientifically, was:

> "Is it likely, or possible, that gas under high pressure will ignite on being released suddenly, through a small opening, in the absence of a flame or spark?"

Mr. J. D. Shattuck said that he had had a good many occasions to let out gas suddenly. "The tendency of the gas is to cool on expansion so that there would be no heat caused by the friction of the gas coming through the outlet sufficient to ignite it." There is more or less moisture accompanying the expansion, and Mr. Shattuck said this would prevent the development of electricity.

Mr. Isaac N. Knapp made note of the conditions obtaining in the natural gas wells, and stated that there was no instance of such ignition on record.

The President drew attention to the fact that sparks were often developed from insulated boilers experimentally, and that such had been developed from chance insulated pipes.

Mr. Knapp remarked that the opening of the gas well was practically insulated.

Mr. Thos. D. Miller then remarked that he put the question in the box, and gave an account of a curious accident which had happened within his knowledge, giving the following incident as the cause of his question: A break about an inch long occurred in a line under 40 pounds pressure, and a man attempted to hold the rent closed with his hand. Forced to give up the attempt, he let go, and as he did so the gas ignited. There was no one passing in the street and there was no fire near. The men said that there was no light in the house and they seemed convinced that the ignition was spontaneous.

Mr. Miller said that he was at a loss to understand what had happened. The gas had ignited, yet there seemed to be no adequate cause; but the theory of an electric spark seemed faulty. The pipe went directly into the ground.

Mr. J. C. Sloan asserted that it was illuminating gas, and then said that he had known natural gas to ignite by reason of the deposit of carbon in the pipes, which ignites in contact with the atmosphere, and the needful conditions might have existed here.

Mr. Robt. M. Searle suggested, that a man well grounded might develop a discharge by the friction of his hand on the pipe, or there might have been a spark exciter, as when one lights the gas by means of the spark from his fingers, or when the fixture is charged and the spark goes to the fingers.

Mr. Miller said that the pipe was of 4-inch wrought iron, coming directly from the ground. The man held back the pressure until the blood was forced through his hand. He then tried to put his hat in the place of the hand when the gas ignited.

Mr. W. C. Morris said it seemed that the cause of such an accident might be a foreign substance in the pipe, which, coming in contact with the pipe, caused ignition.

Mr. D. R. Warmington suggested that carbon disulphide under high pressure would ignite spontaneously.

The President then changed the direction of the argument by asking Mr. Stone if the carbon he spoke of ignited spontaneously on atmospheric contact.

Mr. J. C. Sloan stated that, during the famous slack pressure in Detroit, when the service pressure dropped from 100 pounds to 2 pounds, vast quantities of carbon were deposited in the pipes. When removing this deposit the men had to exercise great care lest explosion and spontaneous ignition were occasioned.

The Secretary asked if there were any signs of oil coming out of the pipes with the gas, because a few of the lighter oils ignited at remarkably low temperatures.

Mr. Miller could not say. Things were pretty badly burned up.

Before recess one more question was taken up:

> "What gas companies in the United States have tried profit sharing plans or co-operative methods with their employees, on what lines and with what success?"

The President called up Mr. Cowdery, who stated that such a scheme, a bonus on the wages, had been worked in Milwaukee. He did not know how much the men liked it, but the wives of the men did. The Company had increased the bonus instead of wages on one occasion, but generally he did not seem to think the scheme of any use.

Mr. John West, of Manchester, England, was invited to express himself on this matter, which he did in an interesting way, but he distinctly showed his preference for the system of piecework.

COMMITTEE ON UNIFORM ACCOUNTS.

Mr. Fred. H. Shelton then took the floor and advocated an adequate appreciation of the efforts of the Committee on Uniform Accounts, moving a special vote of thanks to the Committee (Messrs. Humphreys, Lathrop and Lillie) for their effective work in standardizing accounts on behalf of the Association.

Mr. W. L. Cosgrove seconded the motion, in a few well chosen words. He had not criticised when presented, but he had not failed to appreciate it.

Mr. S. N. Blake urged the Committee not to be discouraged if the progress of the new system was slow, but gradually the companies would turn to it as the best, as they from time to time needed information.

After the passage of the vote the President made the formal statement, and Mr. Alex. C. Humphreys the formal reply, adding that the vote should include Messrs. E. L. Brundrett, Walter Elliott and G. W. Curran.

The Association took a recess until 2.30 P.M.

FIRST DAY—AFTERNOON SESSION.

AWARD OF THE BEAL MEDAL.

Mr. Walton Clark, Chairman of the Committee to award the Beal Medal reported, as follows:

American Gas Light Association: Your Committee to award the "Beal Medal" to the writer of the best paper presented at the 1902 meeting of the American Gas Light Association, appointed by the

President, under authority of the Council, granted October 20, 1897, as follows:

"Mr. W. R. Beal having offered to present annually a gold medal to the writer of the most valuable paper presented at each meeting, the Council accepts the same with thanks, and recommends that it be known as the 'Beal Medal,' and be awarded by a committee of three appointed by the President from among the Past-Presidents,"

respectfully reports that it has awarded this medal to Mr. I. N. Knapp, of Philadelphia, Pa., for his paper on "Notes on Cement Masonry."

CHARLES H. NETTLETON,
C. J. R. HUMPHREYS,
WALTON CLARK, Chairman, } Committee.

The report was adopted.

The reading of papers was then taken up. The President introduced Mr. A. C. Humphreys, of New York, who read a paper entitled

OUR CORRESPONDENCE SCHOOL.

[For the text of Mr. Humphreys paper, see JOURNAL, Oct. 26, p. 643.]

Discussion.

As a prelude to the discussion the Secretary read the following paper, in connection with the Correspondence Class, contributed by a member thereof—Mr. C. D. Robison, Auburn, N. Y.:

Being one of the members of the first section of the Educational Class, I am deeply interested that the work of this Class be extended.

When a young man finishes his high school work, what knowledge he has touches so many subjects, each one so superficially, that he has an idea it is impossible for him to acquire any knowledge of the technical side of his work. The text books on the subjects in which he is interested go so much into detail, and give so much information that is foreign to the work in which he is engaged, that he can see no connection and becomes discouraged. The effort to work by himself, without any encouragement, is so great that he soon becomes absolutely discouraged and gives up the hope of acquiring any information on these matters. To men who have had this experience, the Educational Class of the American Gas Light Association comes as a Godsend. The questions given by the Trustees apply directly to the work in hand and require the reading of books that are of practical interest to the student. A superficial examination of papers would lead anyone to believe that there is small work on them to require three years; but in answering the questions intelligently it is necessary to read parts of treatises on masonry construction, heat and several works of chemistry and physics, both elementary and advanced, and the files of both the JOURNAL and "Progressive Age."

The questions are put in such a way that the practical application of the information asked for is very evident. This gives the student an incentive to keep at it, which is necessary where a man works all day and is obliged to do his studying at night.

The assistance of the Secretary is of inestimable value. In my own work I feel the greatest gratitude to him for the universal courtesy and encouragement which he gave me in my work. The personal factor which enters so largely into college instructions, and which is so lacking in self-education, is very largely supplied by the Secretary's kind consideration which is always extended to the students.

In regard to the practical results of this work, the value of the school is not so much derived from being able simply to answer the questions, as it is from the intelligent interest it gives men in their work. A man who takes no interest in his work is of little value, and if he has no knowledge beyond that required to do the mechanical work he has in hand, he will take no interest. A man who is working and thinking ahead of his present position is worth double to his employers that which one is who is barely thinking enough to hold down the position in which he is at present engaged.

As a general thing, a college man has something better in view than a subordinate position, particularly in a small gas works, and if he is any good, by the time he begins to be of some use, he pulls out; while the men educated by the Class, having smaller ideas and opportunities, are more apt to stay with the smaller companies and make very valuable men for them. The smaller companies are simply conserving their own interests when they encourage their men to enter the Class or contribute to its support. I would almost guarantee that most students would suggest some saving or improvement in the operation of any gas plant with which they chanced to be connected, during the 3 years' course, that would save their employers more than the cost of their tuition.

The President said the Robison prelude was a good indorsement, and he hoped some of the members would now take part in the debate.

Mr. R. M. Searle told of the influence of the reading the school brought out, and the indirect way in which it did good in causing men to read and study. He considered the indirect influence for good even more important than the direct one.

Mr. Walton Clark considered this a more or less critical juncture in the history of the Class, and then went on to say:

It is known to you that I am and have been interested in the work of the Correspondence School. The part that I have taken in this work has been so great a pleasure to me that I am not able to flatter myself that Mr. Humphrey's kind suggestion of unselfishness is deserved. Our work reaches a class that never before has had, and that without your subscriptions never would have had, either the education we give them, or its equivalent. Our students cannot go to college; they must be earning a living for themselves, and, in many instances, for their dependent families. They are mostly men of little education. Many of them do not know how to study on their own account, and a part of our task is to teach them how to study. Correspondence schools, as I understand them, ordinarily teach a class practically as a whole, and they are run for the profit they can earn. The highest degree of success in our work will never be attained by a man who is working only for the money there is in it. Our students need the guidance of a man who has been through their experiences, knows their work and has at least a little of the missionary spirit. Such a man may teach them many things not heretofore set out in the literature of the profession. That we do our peculiar work more thoroughly than other correspondence schools could or would do it, is, I think, highly probable. Certainly we do our work better than do other correspondence schools, as far as they have come under my observation. I have recently had occasion to read the questions and answers on gas manufacture of a well-known correspondence school. The inadequacy of these to the needs of the student cannot be better illustrated than by saying that in this case there was no description given of the operation of an exhauster, a station meter, or a governor. A cut showing the exterior of each of these was presented and a statement made as to its functions; but its internal structure and method of operation were ignored. Going back to my own early days in a gas works, I remember that each of these pieces of apparatus was a mystery to me, and that I arrived at a knowledge of them after much time and labor and considerable explanation. I could see the outside of each of them, but the inside was a closed book to me. I was so fortunate as to be under a man who was determined that I should know these things, and he helped me largely. There are many men in the business who are not so favorably located and who cannot learn those things without assistance from us or from some other correspondence school, or by the slow and to your companies expensive methods of the school of experience. I ask you, if you are in any doubt as to the value of our explanations, to read the description of the construction and operation of an exhauster, on page 76, Vol. 17, of the Proceedings of the Association; of a street main governor, on page 26, Vol. 15, and page 84, Vol. 19; and of a station meter, on pages 32 and 41, Vol. 14. I select these as being devices particularly difficult of description. I have been more or less a reader of books on the gas industry for 30 years, and I do not hesitate to say that there is nothing in the English literature of our industry as clear and as well adapted to the understanding of the educated, or the uneducated, mind, as the descriptions of apparatuses and their construction as given in the answers of your trustees to the questions of the Practical Class. It is not surprising that this is so. Many of these are the work of days. They are written by men familiar with the business—men who have seen, dismantled, repaired and singed their hair and barked their knuckles in operating the types of apparatus described; and they are subjected, before issuing, to the criticism of other men, similarly acquainted with the machinery of gas manufacture and distribution. So good do I regard these questions and answers that I use them in my business. We refer to them in my office, and I have kept copies for those of my sons who are expecting to enter the engineering profession. With a full appreciation of the ability and attainments of the members of the American Gas Light Association, I say to you that none of you can fail to benefit from reading the questions and answers which your trustees send out to the members of the Practical Class.

The work of educating men engaged in the humbler positions in the business of manufacture and distribution of gas is carried on in Europe on lines very different from these which we believe are best adapted to our conditions. In England, as you know, there are the examinations of the London Guild. There is no attempt made at education, but the Guild will examine such applicants as present themselves, and will award certificates in two classes—the ordinary grade and the honor grade.

This is a very useful work, and I have derived great benefit personally from taking these questions, as they appeared in the *Journal of*

Gas Lighting, and endeavoring to answer them. But, as you observe, there is no effort at education. It is simply a test of knowledge. That this work is not satisfactory to those who carry it on, nor to the gas men of England in general, is pretty well evidenced by an editorial in the *Journal of Gas Lighting* of October 30th, 1900, from which I make the following scattered extracts:

"Through almost all the examiners' reports there runs the same line of criticism, which points to the probability that the institute is not getting at the right order of learners. Many candidates for all sorts of examinations are clearly certificate hunters, whose object is to equip themselves with as many of these fallacious testimonials as they can obtain by 'getting up the subject.'

"Over and over again the examiners complain that the real workmen entirely fail to show an intelligent appreciation of the science of their craft; other candidates who are good at the paper work are complete failures as workmen.

"So far as instruction in the elements of gas manufacture are concerned, the record does not compare favorably with the American work to this purpose."

These adverse criticisms cannot apply to our work, for we do reach the real workmen. He must be a workman in order to be a member of the Class. It is obvious that a system of instruction such as we have inaugurated, with your authority, is much better than the simple test of knowledge, which the Guild undertakes; although that in itself is valuable.

In France there is no regular instruction for students desiring a knowledge of the gas business. The only instance of any course in this line known to me is in conjunction with the technical school at Lyons, where day and evening classes are held. The lectures in this school are given at night, and of course, are available only to residents of Lyons and its vicinity.

Considerable attention has been given of late to the special instruction of gas works workmen in Germany, and a committee on this subject has been appointed by the German Association of Gas and Water Engineers. There are in Germany, at least five institutions or enterprises for giving this instruction:

1. A four to five year course at the technical high school in Karlsruhe, for the education of gas engineers. This is a fine work for men who are able to give the time and stand the expense of residence at the location of the school.

2. There is a course of lectures at the same place, under the auspices of Dr. Bunte and others, for men employed in a technical capacity at gas works. These lectures were begun in '98, and relate chiefly to gas chemistry, and are attended mostly by chemists and engineers employed in the local works. It is probable that this work is highly beneficial to those whose circumstances permit them to attend. But such a system would not be at all applicable to the class who are reached by our school.

3. There was established at the Dessau gas works a course of instruction, extending over two years, for the benefit of students or employees aspiring to the position of superintendent or foreman. This course is a private enterprise, conducted by the Dutch-Continental gas people, in connection with the Dessau Gas Company, and is primarily intended to provide the Company's needs of foremen.

4. A private enterprise, chiefly to instruct in gas fitting, was started in the town of Stolp. It was not a correspondence school and a fee was charged.

5. In Bremen there was inaugurated in 1902 a course of instruction for gas superintendents and foremen, comprising 3 months' tuition, partly at a technical school and partly at the gas works. I have very little information as to this course.

The correspondence system of instruction in the gas industry does not at all exist, as far as I am informed, in Germany. I do not know of any country in which a system of instruction such as you have inaugurated prevails. None of the schools above described would meet our conditions, or do the work that the Trustees are endeavoring to accomplish.

This work is well worth while, whether we regard it as a philanthropic measure or as a commercial venture. I believe that we are broadening and strengthening the foundation upon which the conduct of our industry must rest when we broaden the minds of the men who occupy the subordinate positions in gas works. The work of the Trustees does more than merely instruct these men in the construction and operation of the plants with which they were connected. It teaches them how to study, how to use books, to think clearly and how to express their thoughts on paper, while it is making them more serviceable and contented employees of the companies for which they work. The interests with which I am connected have means of educating their own employees. Also we encourage our men to enter the Practical Class—many of them are members—and we so far appreciate the value to the industry of insuring that the men who are occupying humble positions in gas works other than our own, shall be broadened in their knowledge and understanding, and so far believe that the method adopted by the correspondence school will accomplish this end, that we are and have been from the beginning a large contributor to the Trustees' fund. In making this contribution, as employees, we believe we are doing our duty to our stockholders, who look only for dividends. As individuals we are gratified to believe, that this once at least, business and philanthropy travel the same road, and that our contribution is aiding in the work of broadening men's minds and letting in light to dark places, and so helping on the good work of elevating the mental and moral tone of our associates in the ranks of the gas industry.

The President said the criticisms so far seemed all on one side and to the good, but he hardly believed the School perfect. If no one else would talk, the meeting would hear from the man who had charge, Mr. A. E. Forstall.

Mr. A. E. Forstall then followed with a paper suggesting some changes in detail which he impressed upon his hearers would help the school but not him:

In discussing the subject covered by Mr. Humphreys' paper I propose to treat of the possibilities of the work carried on by the Trustees' Gas Educational Fund rather than of what has been accomplished in the past, because no matter what the past, unless there is good prospect of usefulness in the future, there is no argument to urge for a continuance of the Practical Class.

While it is not at all necessary to prove to the members of this Association the dollars and cents value of education it may not be out of the way to remind you of it. Let us look at the subject of generator firing of retort benches as an instance. There is no question that properly handled generator furnaces, and especially generator furnaces to which are added efficient recuperators, are a great economic advance over direct-fire furnaces, and yet several of the earlier installations were condemned simply because, by reason of ignorance in the retort house, they were not properly handled; and even now the same ignorance often prevents the obtaining of the best results. No man can make a success of generator firing unless he understands clearly what are the principles underlying it. These principles and their application are simple and can be easily taught to the retort house foreman, but until he learns them he cannot be expected to know that, within certain limits, the cooler the fire in the furnace the hotter the setting, and that increasing the draft may decrease the heat of the retorts and will certainly increase the fuel consumption. The difference between a knowledge of the theory of generator firing on the part of the man in charge of the retort house and no such knowledge, may easily be a difference of 20 per cent. in the make per retort and of 25 per cent. in the amount of fuel used and you can figure for yourselves what this means in good, hard cash.

In addition to the advantages to be gained from the practical application to specific operations of imparted knowledge of underlying principles there are also great advantages to be derived from the training of an employee to think about his work and the things he sees around him every day, and in this way to bring the knowledge that he already possesses upon his daily task. As long as existing conditions are accepted as a matter of course, and no thought is given to the reasons for them, there can be no improvement; but can there be any question as to the improved practical and economic results that would follow the asking and correct answering of the question, "Why do I do this in this way?" by every employee of a gas company, from the President down, every time he performed any duty. Everyone of us is inclined to accept things as we find them, simply because we have not been thoroughly trained to make certain that we really understand what we are doing, and why we are doing it in a particular manner. Frequently, however, only a little thought is necessary to make us see that there are better ways of going to work, or possibly that there is absolutely nothing to be gained by what we are doing. The cash value to the employer of an education that promotes a laudable inquisitiveness on the part of the employee can easily be appreciated by a little consideration.

With so much by way of a reminder that the proper education of employees will represent value received to the employer, the question "Can the Practical Class give such an education?" is now to be taken up.

The ideal education is unquestionably that derived by a very small number of students from an instructor who knows each of them thoroughly, through intimate association, and can thus suit his instruction to the individual needs. The ideal is, however, proverbially difficult of attainment, and in technical education is practically never reached. In the gas business ideal education is only possible in the comparatively rare positions where the subordinate with the desire to learn has a superior with the ability and the willingness to teach. The nearest

approach to this would be a class with the freedom of all departments of a gas company's business under an instructor fully qualified by a combined theoretical and practical knowledge of the subject. Membership in such a class is, however, necessarily limited to residents of the particular locality or its immediate vicinity, or to those who can afford to live away from home and devote all their energies for a given time to the acquirement of their education. The Practical Class was started and is carried on to meet the wants of those who, though anxious to learn, could only do so while earning their living by work in positions such that it would be impossible for them to take vacations of any length without loss of income and even of position.

Such men cannot come to the instructor and are too widely scattered to make it possible for the instructor to go to them, and nothing remains but instruction by correspondence. In teaching by correspondence it is not a matter of any great difficulty to set forth clearly the principles and facts that should be learned, but it is hard to make certain that they are learned in such a way that the student can at any time give a reason for the faith that is in him, and still more difficult to establish habits of inquisitiveness in the members of the Class. With some these objects can never be obtained, just as some never derive any great benefit from even individual instruction, but in many other cases the student can be made a well informed and reasoning gas man.

This is done to a certain extent in the Practical Class by the character of many of the questions given, which, following a suggestion made by Mr. Alex. C. Humphreys, when the Educational Committee was first organized, are designed to make the students think about the things that they see about them every day. But the process can be completed only by the meeting by the instructor of the individual wants of each man. To enable these to be known it is necessary that the instructor have time to study the requirements of each individual and that the answers and letters of the students be such as to show their several needs. The man who puts something of himself into his answers and asks questions, in addition to answering those sent him, gives to the instructor a knowledge of his requirements that enables them to be fully met, and such a man derives the greatest possible benefit from the course. But if every member of the Class were to do this no one person could take care of a Class of its present size, even though devoting all his time and energies to the task, and still less could it be done under the present conditions of income which do not permit of securing the full time of an instructor qualified for the position.

The experience of the past 5 years seems to show that the average number in the class will be about 100. Four sets of 12 questions are sent to each of the 3 sections each year, making a total of 144 questions per year. The preparation of the answer to each new question will require on an average one day, even when no drawings are required. If half the questions are new, 72 days will be required for the preparation of answers to them, leaving, with no allowance for vacation, only 228 working days in which to study and attempt to meet the requirements of 100 separate individuals, or an average of 2¼ days per man per year, or only a little over one-half day per man per set of questions. As a matter of fact the correspondence connected with the handling of the subscriptions and the enrollment of new members, and the general work of carrying on the Class will cut off more than the odd 28 days, leaving less than one-half day per man per set of questions. That is surely not an exorbitant amount of time to be devoted to each student, if the best results are to be obtained.

To secure ths full benefit that may be derived by the gas industry of this country from the Educational Fund the annual income should be increased to an amount that will make it possible to pay to the instructor the salary that the position is worth, and to also pay all office rent and for all the clerical assistance that is required to carry on the work of the Class. This would call for an income at least $1,000 per year greater than it has been during the period just ended.

In my position I have been able to observe the eagerness and gratefulness with which the opportunity afforded by the Practical Class is grasped, the earnestness with which the work is carried on, and the amount of benefit derived from it by those who take full advantage of its opportunities. As an example of the benefit derived I may instance the case of one of the students who, in 1899, was a boy of all work in a gas works, and is now in charge of the works and the laying of street mains for a company selling fully 30,000,000 cubic feet per year, and that of another boy who, starting as store room boy, has also become a works' manager. These cases occur to me because I knew the boys and put them in the Class, and not because they are the only ones of the kind. Having seen the good that has been done even under the part time arrangement existing at present, I can realize the greater good that might be done under improved conditions, and I most earnestly hope that the members of this Association and all interested in the gas business will by their subscriptions make it possible for the work to be carried forward to its full development.

Mr. John West, of Manchester, England, spoke at length regarding that which was being done in England in educational lines for young men who thought of going on in the gas trade. His final sense of the affair was that the Educational Class in America was at least equal to anything that had been or was being done in England towards instructing on similar lines.

Mr. Jas. Somerville also gave hearty word of encouragement for the Class and its objects, as did Mr. Wm. R. Beal.

The President called on Mr. Alex. C. Humphreys who said that members were at liberty to dissent and discuss. He knew there were differences of opinion and he believed the place and time to bring the matter to a focus was then and there. Mr. Humphreys told of a visit he had received at some length, but the importance of his expressed opinion is to be found in this statement of fact following it:

"They expressed but limited interest in our strictly technical work, but when I spoke of the underlying methods they were alert at once." Correspondence methods interested them specially. Mr. Humphreys further insisted on forbearance towards the shortcomings of pupils, asking that those who came in contact with them would not be hasty to condemn the school for the deficiency in the men. The best intentioned teaching will sometimes miss the aim of the teacher. "We can give men education but we cannot guarantee to make them efficient men," said he. This fact Mr. Humphreys reminded his hearers was as patent in the work of the colleges as in that of the correspondence schools. He also reminded the members that in asking for an increased appropriation for a salary for the man in charge, Mr. Forstall was speaking not for himself but for his succe ssor. Still he considered it best to put one man at this task, even if it were one difficult for a single man to handle, because there was no need, in his judgment, for dividing the teaching duty. One all around competent was in his judgment better than a number of competents.

The President closed the matter by thanking Mr. Humphreys in the name of the Association both for what he had written and for what he had said.

(To be Continued.)

The American Separately Fired Superheater.[1]

Since the mechanical difficulties incident to the use of superheated steam have been in a large measure successfully met by improvements in packings, lubricants, piping, etc., the economies which may be effected by employment of high temperatures of steam have of late been attracting more attention than formerly. Our friends abroad have done much along these lines, and have taken the lead in experiments with superheaters and superheating. In this country comparatively little has been effected in these directions, but at the present time our knowledge of the subject and its practical features is taking a more advanced position. Installations of equipment for generating and using superheated steam are now so numerous in various parts of the country that the element of novelty is no longer of prominence. Periods of practical use and results of thorough tests are not yet such as to lead to a very rapid adoption of the principle, even though its evident theoretical advantages, and so far as service trials indicate, its actual economies, show that its general adoption would be advisable and may be ultimately expected. The avoidance of at least a large share of the losses due to condensation between the boiler and the engine and within the engine itself is the principal advantage to be derived from superheating, in addition to which are other savings, among them an improvement in the benefits resulting from compound and multicylinder engines.

The vital point in the matter lies in the efficiency of the superheater itself. Here are experienced the greatest difficulties since means of handling and using the high temperature steam have been devised. Two types of superheaters are in use; one is fitted as an adjunct of the boiler and provides for passage of the steam from the boiler proper through a system of tubes placed somewhere within the current of hot gases from the boiler furnace. The other type is entirely independent of the boiler, and is provided, generally, with its own furnace, the steam from the boiler passing through the superheater on its way from the boiler to the engine. The illustrations herewith show the appearance and construction of the American superheater, which is evidently of the second type named. The makers of this superheater believe that

1. *Iron Age.*

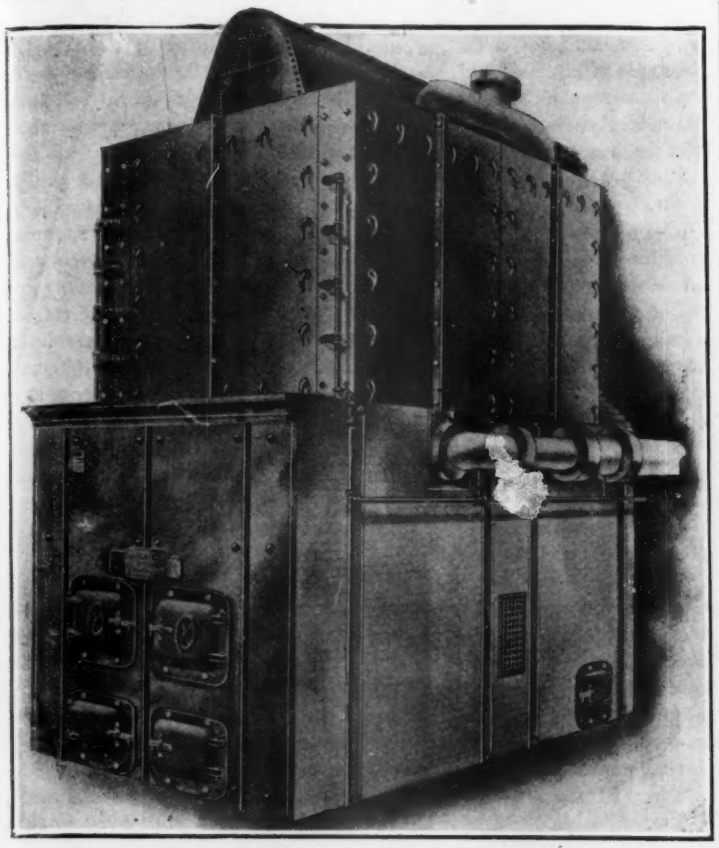

Fig. 1.—General View of the American Superheater.

the independent or separately fired type offers mechanical and commercial advantages due, for one thing, to its ease of application to existing plants without disturbing the boiler equipment in any way. The piping system alone need be so altered as to provide for conducting steam from the boilers, either through or past the superheater, thus enabling the latter to be used or cut out, as circumstances may require. The use of an independent fire for the superheating makes possible a greater flexibility and wider range of temperatures than is practicable where the boiler furnaces must be depended upon.

The American superheater consists of a furnace of the reverberatory form, Fig. 2, from which the gases pass over the bridge wall, downward

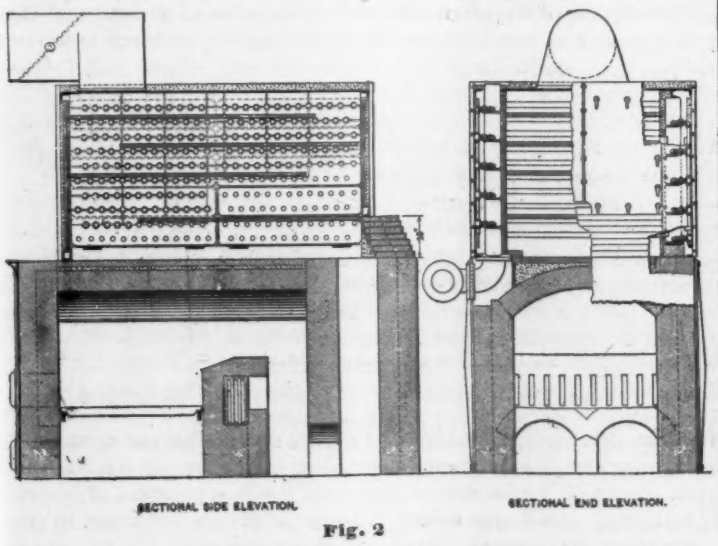

Fig. 2

through the combustion chamber, and thence upward to and among the heating tubes.

The steam to be superheated enters at the inlet connection seen at the top in Fig. 1, passing directly into the topmost steel headers, whence it flows through the tubes to the headers on the opposite side. Similarly, from the further side the steam returns to the second headers on the inlet side, and passes thence from side to side successively through the several tube sections, constantly approaching the bottom of the tube system, and finally leaving from the lowest headers by way of the outlet connections shown in Fig. 1, and at the left of the end elevation in Fig. 2. By this generally downward passage of the steam continuously hotter furnace gases are encountered, the gases being constrained in their course by the refractory tile baffle plates and caused to pass all the tubes in a direction transverse to their lengths. Having given up all their available heat to the tubes and their contained steam, the products of combustion reach the flue connection at the top and pass out.

The furnace bridge wall is hollow, and at each end of the open space is a register in the side walls through which air enters to temper the initial heat and assist in effecting perfect combustion by mingling with the gases as it issues through openings in the back of the bridge wall. This provision for regulating the temperature of the products of combustion, together with the heat storing capacity of the large area of exposed firebrick, enables the attendant to maintain in the steam supply a very nearly uniform degree of superheating, even under conditions of wide variation in the quantity of steam passing.

The superheating tubes are expanded into the headers, and the joints are protected from direct contact with the hot gases by vertical tiles and nonconducting material. The tubes are all straight and of standard commercial sizes. The header openings opposite the tubes are spot faced and are closed by removable plates, held in place by bolt, crab and clamp, the joint thus being similar to that used generally in inside packed boiler tube construction. The sides and ends of the superheater are inclosed by removable casing plates, faced on the inside with heat insulating material. The whole tube and header system is thus made readily accessible for cleaning and repairs. The dead air in the spaces between the headers and the outer casing plates keeps the headers at temperatures only slightly in excess of those of the steam passing through them. Costs of repairs are reported to be very light, practically nothing having thus far been required in this way by a superheater of this type installed in the year 1900 at the Lowell, Mass., mill of the Merrimac Mfg. Company.

It would appear that the uniformly moderate temperature of the whole body of heat conveying gases cannot but have a desirable effect in avoiding sudden and excessive stresses due to expansion and contraction, and in preventing injury to the tubes, while the ease of regulation of the volume of the gases provides means for holding fairly constant the degree of superheating.

The Products of Combustion of Some Gas and Oil Stoves.—Home Office Report.[1]

In the annual report of the Chief Inspector of Factories and Workshops for the year 1902 there is (pp. 269–71) an interesting record of experiments conducted on certain types of gas and oil stoves. This record is embodied in the report of Dr. T. M. Legge, H.M., Medical Inspector of Factories, who appears to have had his attention attracted to the matter through inquiries made by two lady inspectors, and thereupon asked Dr. Thorpe to carry out "a series of experiments as to the presence of deleterious compounds in the products of combustion given off by certain stoves commonly used in factories and workshops." Dr. Thorpe sent the following particulars in a letter to Dr. Legge on the subject (the names of the makers of the stoves alone being omitted from the reproduction of the letter in the Home Office report):

The Stoves Tested.—In "A" stove the burner is of the Argand type, giving a luminous flame, which does not impinge upon any so-called "fuel" or other solid substance. The products of combustion circulate through a system of air chambers, and the gaseous portions eventually pass into the room. Much of the moisture is condensed and drips into a receptacle at the bottom of the stove, carrying with it dissolved sulphuric acid derived from the burning of the sulphur compounds originally present in the coal gas.

The burner in "B" is of the atmospheric or Bunsen type, giving a non-luminous flame, which impinges on perforated fireclay tubes. The products of combustion pass up one air chamber at the front of the stove and down a similar chamber at the back, whence a tubule for connection with a flue leads them from the stove.

In "C" the burner is also of the atmospheric type, and the non-luminous flame impinges at its tip upon fireclay skeleton "fuel." The combustion products pass up a system of tubular pillars to a flat chamber at the top of the stove, thence down other pillars to a similar chamber at the bottom, and so out into the room, a portion of the moisture being condensed, as in the "A" stove.

Before proceeding with the investigation a letter was addressed to the makers of the stoves, asking them to rebate the conditions as to gas pressure and rate of consumption under which they considered their stoves should be tested. The substance of the replies was as follows:

1. *Gas World.*

"A" stove.—"There is a regulator fixed under the burner to prevent the flame running to smoke. The regulator will come into action at 15-tenths pressure. The gas consumption, when the gas is full on, should be 8 feet."

"B."—"The stove has burnt steadily at 7-tenths of an inch pressure, and the rate of gas consumed with the 10 tubes ignited is slightly under 20 feet per hour."

"C."—"The stove does not profess to carry away the whole of the deleterious products; it is only recommended for use in faialy well ventilated situations where it is not possible to use a flue. Our 'C' should be fixed with a quantity governor, limiting the gas consumption, at 10-tenths pressure, to 15 cubic feet per hour."

With regard to "B" stove, I may say that it was found impracticable to light the burners at the pressure mentioned by the manufacturers—7-tenths of an inch. After communications had been passed, the manager of the firm in question paid a visit here, and upon witnessing the behavior of the stove expressed himself as satisfied that a higher gas pressure than that mentioned was necessary for proper working.

Methods and Results.—Carbon monoxide and acetylene were the deleterious substances specially tested for in the escaping gases. The stoves were examined in two ways: (1) by burning them openly in the room and withdrawing the combustion products direct from the outlets of the stoves; and (2) by allowing them to burn under a large cover provided with adequate inlets and outlets for air, etc., the products of combustion being taken from under this cover for analysis. The latter method imitates, in an exaggerated form, the conditions under which the stoves would be burning if used in a small ill, ventilated room. The following are the results obtained:

I.—*Stove Burning Openly in Room: Products Drawn Direct from Stove.*

Stove.	Gas Pressure. Inches of Water.	Gas Consumption. Cubic Feet Per Hour.	Carbon Monoxide. Per Cent. by Volume.	Acetylene.
"A"	1.05 to 1.50	7.5 to 7.8	Traces ranging from 0.001 to 0.005 per cent.	Absent.
"B"—First stove	1.40 to 1.50	19.4 to 19.8	0.032 to 0.041 cent.	"
Second stove..	....	....	....	
"C"	0.85 to 1.00	12.6 to 14.7	Traces ranging from 0.002 to 0.007 per cent.	"

II.—*Stove Burning Under Cover: Products Drawn from Under Cover.*

Stove.	Gas Pressure. Inches of Water.	Gas Consumption. Cubic Feet per Hour.	Carbon Monoxide. Per Cent. by Volume.	Acetylene.
"A"	0.85 to 1.45	7.0 to 7.5	Traces varying from practically nil to 0.003 per cent.	Absent.
"B"—First stove...	1.90	19.9	0.047	Nil, or at most inconclusive indications.
Second stove..	1.20 to 1.50	17.2 to 19.5	0.034 to 0.048	"
"C"	0.90 to 0.95	14.6 to 15.1	Traces ranging from 0.002 to 0.003 per cent.	Absent.

These results, as they stand, are not comparable with one another, because the products analyzed are not drawn from the same points relative to the burners, and the degree to which they are diluted with air is consequently variable. But by making a simultaneous determination of the amount of carbon dioxide present in the products of combustion, the quantity of monoxide found can be connected accurately with the volume of gas burned. From the known composition of the coal gas, the quantity of carbon dioxide found in any experiment represents a known volume of the original gas.

Reduced in this manner to the same standard, namely, the volume of carbon monoxide produced during 1 hour's burning of the stove, the results of special experiments made for this purpose give the following comparison:

Stove Burning Openly in Room: Products Drawn Direct from Stove.

	Inches.	Consumption. Cubic Feet Per Hour.	In Products Analyzed— CO_2 Per Cent.	In Products Analyzed— CO Per Cent.	Carbon Monoxide Produced in One Hour's Consumption. Cubic Feet.
"A"...	1.50	7.5	1.841	0.0012	0.0024
"B"...	1.50	19.8	6.696	0.0320	0.0480
"C"...	1.00	14.5	2.697	0.0018	0.0048

In the case of the "C" stove (*sic*), the characteristic blood reactions for the presence of carbon monoxide, namely, the absorption spectrum of carbonyl-hæmoglobin, was obtained without difficulty in the products drawn direct from the stove. In the case of the other two stoves the amount of carbon monoxide is too small to be detected by this means, and the test was consequently not applied.

It will have been noticed that no acetylene was found in the products from any of the stoves.

Deductions from the Results.—As regards the significance of the numbers for carbon monoxide given in the last table, from the hygienic point of view much, of course, will depend upon how far the products are allowed to accumulate—in other words, upon the ventilation of the room in which the stoves are burned. Supposing as an extreme case that the stoves could be each burned in a closed cubical room of, say, 10 feet side, the average quantity of carbon monoxide in the air of the room at the end of 1 hour would be—

With "A" stove.....	.00024 per cent.
" "B" "	.00480 "
" "C" "	.00048 "

In 5 hours the corresponding figures would be 0.0012, 0.0240 and 0.0024 per cent., respectively.

In practice this precise state of things would, of course, never obtain, since there would always be more or less ventilation. But, on the other hand, in practice, the products of combustion would not be equally disseminated throughout the room, and workpeople engaged at particular spots might have to inhale far more than the average quantity of the products of combustion. The foregoing figures, therefore, may serve as a very rough sort of criterion whereby to judge what would be the actual conditions in a small, badly ventilated room.

The "B" stove should not, I think, be used except in attachment to a flue. The products of combustion drawn from this stove produced distinct symptoms of poisoning in mice after about an hour; and although, when diluted with air to the extent which would be reached in practice, they might not give rise to any very serious effects on the human system, it is still quite conceivable that they might produce minor evils, such as headache, lassitude, depression of spirits, and so forth. The stove is, in fact, as already mentioned, fitted with a tubule for connection with a flue; this connection should, in my opinion, be always insisted on.

II.—*Oil Stoves.*—Two specimen stoves were sent me by the Office of Works. Both these stoves have a circular reservoir through which passes a central air tube, and both have wicks of the cylindrical type. The flame of the "D" stove is non-luminous; that of the "E" heater is luminous. Kerosene is the fuel employed in each case.

The two stoves were tested by examining the products drawn directly from the top of the stove. In both cases a small quantity of carbon monoxide was found, the results of the experiments being as follows:

Stove.	Consumption of Kerosene. Ounces Per Hour.	In the Products Analyzed. CO_2 Per Cent.	In the Products Analyzed. CO. Per Cent.	Carbon Monoxide Produced in One Hour's Burning. Cubic Feet.
"D"—(1) Turned fairly high.....	5.9	11.781	.029	.025
(2) Turned very low.....	4.0	7.919	.022	.017
"E"—Practically at maximum....	10.7	5.458	.010	.032

It will be seen that these quantities of carbon monoxide for the hour's burning are appreciably greater than those yielded by the "A" and "D" (*sic*) gas stoves on the one hand, but less than that produced by the "C" (*sic*) radiator on the other.

The Development of Conveying Machinery.

The *Journal of Gas Lighting* reports that at the last meeting of the Birmingham Association of Mechanical Engineers, on the 7th ult., Mr. A. J. S. B. Little read a paper on the development of conveying machinery, dealing in turn with its use in the boil er house, in connection with gas producing plants and in gas works.

The object of engineering is primarily the adoption and working of machinery for carrying on industrial operations, with a minimum of physical exertion to the operatives, a maximum of output and no reduction in the quality. Conveying machinery is of comparatively recent origin, and the designs employed up to within the last few years, are, doubtless, known and appreciated by you; so I intend in this paper to describe the gradual advance through progressive changes, touching only lightly on the old designs, but making a complete survey of the modern.

Starting with power producing plants, I propose to deal with the conveyors handling coal and ashes—taking as examples some of the lates

boiler houses in which steam is raised for operating electric generating sets, and also one or two plants in which producer gas is the motive power. In the first case, the object is to take the fuel from trucks, carts or barges, and locate the same to overhead storage hoppers, from which it gravitates through subtruded weighing or measuring appliances to the stokers. After being burnt in the furnaces, the ash is carried away and stored for quick loading to carts or trucks. On the old plants the installation consisted in most cases of a sunk steel hopper, situated at the end of the boiler house, made to hold about 5 tons of coal and feed the same gradually through a controlled outlet to the boot of an elevator, and from there it had to be picked up by small buckets mounted on an endless chain, which passed round wheels at the top and the bottom, and, in going over the top ones, dumped the coal down a shoot into a separate conveyor. This was of the scraper design, which consists of an endless chain with plates about 18 inches by 6 inches, mounted thereon at 2-foot pitch, and propelled along a trough, which allows the coal to drop through several outlets into the hoppers. Sometimes on small plants a screw or belt conveyor would be substituted for the scraper; but the general arrangement did not vary. The capacity per hour seldom exceeded 25 tons, and the speed of working was anything 60 to 180 feet per minute, absorbing about 0.013 to 0.012-horse power per foot-ton hour.

The coal and ash plants were then quite distinct; and the latter were specially designed to obviate attrition on the steel plates. The usual conveyor consisted of an endless chain with overlapping carrying plates, supported on rollers running in bearings fixed to the framework at 3-foot pitch. The ashes had to be drawn, slaked and then shovelled on to the travelling trays, which dumped over the end wheels into a separate elevator, arranged to load a hopper. The plates were $\frac{3}{16}$-inch thick, 18 inches wide, and the chain 9-inch pitch, of malleable cast iron. The speed of working was 60 feet per minute, the capacity 15 tons per hour, and the power 1 horse for every 30 feet. The conveyor generally passed through the end of the boiler house and dumped into the boot of an ordinary cased elevator.

When large unit power houses became necessary at electric lighting and tramway stations, the mechanical problems involved had to receive attention, owing to the large quantities to be handled; and the result has been a complete deviation from old methods of transport. The coal is brought to the works in trucks, and bottom or end doors are opened to pass the fuel into an underground hopper, below which the conveyor passes. This consists of two rows of chain made of double steel links 12-inch pitch, connected to each other by 1-inch rods, 2 feet apart, and supported by cast iron rollers on light section rails. Intermediate pins are used to form, along with the cross bars, carriers for these rollers, and also serve as swivel pins for the buckets.

Before proceeding to a detailed description, it is advisable to point out the great variation between the arrangement of this and the old style of boiler house plant. Here one conveyor takes care of both coal and ash, though at different times; but as the ash does not come along in such quantities as the coal, it is a simple matter to arrange for the coal storing to be stopped while the ash handling operations are going on.

Only two sizes, in two styles, of gravity bucket conveyors are made in this country. In the one style, there is a space between each bucket, and a filler is used to prevent spilling. The other is made with buckets overlapping, which arrangement dispenses with the revolving filler. The two sizes in each have buckets which hold respectively, 1 and 2 cwt. of coal; and, as the speed is 50 feet or 25 buckets per minute, the capacity of the one size is about 75 tons and the other 150 tons per hour. You will agree that on the old stations such capacities would have been altogether out of proportion to the daily consumption; but on the large new power houses these rates of handling are common. In practice, 50 per 100 tons is the amount carried and stored. In these conveyors the swivel pins are $1\frac{1}{4}$ inches in diameter, and they take the brackets bolted to the sides of each bucket. These brackets have at the bottom a $\frac{1}{4}$-inch pin to carry a roller, which comes into operation when the cams are tipping the buckets, as, no matter through what angle the conveyor works, the buckets hang with their bottoms down, and mechanical means have to be employed to tip them.

Keeping the design of the conveyor in mind, you will now be able to follow the run of buckets round the boiler house. Under the hopper there is an automatic revolving filler about 4 feet in diameter. This loads each bucket as it passes underneath; and there can be no spilling, as the coal which is fed into the filler through a hole in the side can escape only at one of several outlets at a time, and as these, being on the periphery, are closed by the bucket underneath, and as each bucket will take only its prearranged quantity, no overloading can take place. If the conveyor and the filler are stopped, the flow of coal is also delayed. The short horizontal run of conveyor is necessary, as the filler will not feed coal to a conveyor when working on the incline or vertical. Wheels on the right divert the run, and are allowed to revolve, so that, when the rollers in the chain engage with the flange of wheels there is practically no loss of power through friction. Similar wheels are put at each corner of the building. The vertical portion is guided by rails and is entirely inclosed by weather tight steel casing, as is also the top horizontal part outside the house.

I may mention that just after passing round the top corner wheels, there is a set of tipping gear, which dumps the ashes from buckets down a shoot to the hopper; and just beyond this again is a continuous recording weighing machine, which registers the gross and tare simultaneously as the buckets pass on their way to the coal store. Every properly equipped boiler house should have some means of automatically checking and recording the total amount of coal stored, and also the separate quantities daily used on each boiler.

A drawing exhibited by the author showed that each of the three conveyors has a top horizontal run of about 104 feet, and that it is carried on rails fixed to cast iron brackets, bolted to 10-inch by 6-inch longitudinal joists, which are fixed to the roof principals. Besides the one for the ash, there are eight tripping cams for upsetting the coal from the buckets into the large coal pockets. On the down vertical run, there is a loop in which the extra pair of wheels act as drivers, and receive motion through machine cut steel wheels from a 12-horse power motor.

I will conclude the run of the conveyor and description of this plant by taking you along by the ash trench, in which there are two shoots from each boiler to hold and, when required, direct the ashes to the travelling filler; and as this is, in principle, similar to that under the coal hopper, one description will suffice for the two. There is a carriage mounted on wheels, and carrying the bearings and shoot. In the former revolves a shaft, on which is mounted a drum, receiving motion from the conveyor chains by means of a sprocket wheel, while the shoot is fixed to the carriage, and passes into the body of the filler, which revolves round it. The ashes or coal being fed into the shoot find their way to the body of the drum, and can escape through the several holes in the periphery one at a time. Underneath these, the buckets pass; and as the mouths of these fit round the lips on the drum, spilling cannot possibly take place. The filler can be moved right along the trench to take the ashes from any of the shoots.

Perhaps a few figures relating to this plant will be of interest; and I will take the most important first—that is, the cost. One run of conveyor, which would be enough for an ordinary power station, and including all wheels, supports, hoppers, shoots, filler and motor, but no brickwork, would cost from £1,200 to £1,500. It would handle 100 tons of coal per hour, and, besides, load the ashes into trucks. The cost of labor only would be from 0.48d. to 0.68d. per ton, and power required to drive about 0.0033 horse per foot-ton-hour, or, in other words, 2-horse power will convey 100 tons 60 feet every hour. This will no doubt strike you as exceedingly low; but it is the result of actual tests.

At a number of works, power gas plants are being installed. At steel works, gas producers have been erected for heating purposes. Up to within the last year or two, the former were of small capacity; and if a system of coal conveying machinery was put in, it was very small, and only handled about 10 tons per hour—the ashes being taken out by barrow. But, recently, large schemes have been contemplated, and are now nearing completion, in which more extensive transport arrangements are required. The smaller units with (say) four producers, are practically all built on the same principle, in which coal brought in carts or trucks is dumped into a hopper, and fed automattically to the elevator, which is about 62 feet long, erected on a slight angle, and arranged to feed an 18-inch diameter screw or a push plate conveyor, which is provided with two outlets to the hoppers over each producer. In some cases, measuring boxes are built on to the hoppers. An electric motor is erected on the head of the elevator structure, and drives through three sets of cut gearing direct on to the elevator top shaft; a drive to the conveyor being arranged by a chain from one of the intermediate shafts. The cost of the complete plant, with the exception of the producers, is about £450. On a larger plant, with 8 producers in a row, the gravity bucket conveyor can be used; the return strand passing under the producer ash pits, or, if bad ground is found, it can be brought nearer the surface by shifting its line of run to one side. For ordinary work, this design of plant is hardly suitable, as equally good work can be done by separate coal and ash conveyors at a lower capital cost.

The other producer plants mentioned are, in nearly every case, of

very large capacity. The one I am about to describe was put down four years ago; and it is the largest completely automatic producer plant in the country. In this case, hydraulic power is used for tipping the incoming wagons (a ram engaging the axle), and a truck can be emptied in this manner in about seven minutes. Under the ground, there is a steel hopper which holds 20 tons of coal, and is provided with a traveling bottom, which is really the top strand of a 36-inch wide steel belt conveyor, which is used for drawing away the coal in regular quantities—the amount being varied by a sliding door at the end. Delivery is made on to a shaking screen having 5-inch square holes, through which the small coal passes, while the large is shot over the end into a 2-roll crusher; the two kinds meeting under the crusher in the elevator boot. This elevator has 30-inch buckets, which can lift 80 tons of coal per hour to the several conveyors. The arrangement of conveyors admits of coal being carried to cross push plates, which run over three rows of producers, and feed the continuous hoppers, under which 5 cwt. measuring chambers are fixed, and made to discharge direct into the bell mouth of the producer. There is no ash handling plant, as there is a line of rails alongside the producers at a lower level, so that ashes can be shoveled direct to the railway trucks. On some large plants, of similar construction, conveyors for handling the ashes have been in use for a number of years, and a great saving in labor cost has resulted.

I must now ask your attention to some rather difficult problems which have been successfully solved. In all cases, where gritty materials have to be handled, great care must be exercised in selecting the type of conveyor to be used; and where the material is also hot, the difficulties are exceedingly complex. It will occur to you that a case in point is found in every gas works and coke oven plant, where large quantities of coke have to be taken away in regular amounts every day, but in varying quantities at different times of the year. In such works, the call for labor is not at all regular. One of the serious questions presented to the managers is the means of employing coke wheelers in other duties during the slack season; or, if the men have to be suspended, then a worse problem is the obtaining of a sufficient number of suitable men when working at full capacity, and, as engineers would say, with all belts on the small driving pulleys. At a gas works where inclined retorts are in use, each time one of these is discharged there is a 6½-cwt. load of incandescent coke to be taken away; and in an ordinary sized works about 12 retorts will be drawn in quick succession. So that it is evident that, if automatic transport arrangements can be adopted, there will be great improvements.

First, there is the quicker operating of the retorts; and this insures high heats with a low fuel consumption, as, if the mouthpieces are left open long, there is a big loss which has to be made up if the next charge is to be properly burnt off. Then there is the lightening of the men's work, which is, in any case, severe, and the reduction in the number of hands, making the wages bill less. A charge of 3½d. per ton for taking the coke out of the retort house only is not considered high with hand labor; but with conveyors this can easily be reduced to 0.9d. The conveyor can, of course, be adopted in a horizontal retort house; and where power charging and drawing machines are used, the advantages of quick automatic transport are apparent, as it enables the operator to get much quicker work out of the machines.

A recent installation is the plant at the Ipswich gas works, in which the old style of coke conveyor was adopted. There are two conveyors which deliver into a cross transporter, which stacks the coke in the yard, and can also feed a fourth conveyor. This also deposits over the yard, and can, in addition, feed two crushers delivering to screens, which take out the breeze and deliver it to a small storage hopper, the tailings going to 40-ton hoppers. Two hydraulic motors of 13-horse power (47 revolutions per minute) are used for driving the whole plant. A somewhat different arrangement of conveyors has recently been started at the Saltley gas works—not only the most extensive of its kind, but, what is of greater importance, it is admitted by visitors and users to be the best thing in coke conveyors ever put into use. The plant has a capacity of 582 tons per 24 hours; and it takes the hot coke away right from the retorts, quenching it in transit, and delivering it into a large hopper, to be finally lifted by the Goliath crane for loading to trucks or barges. The two engines, which are of local manufacture are each capable of driving the whole plant, so that one is kept stationary when the other is working. The load on each engine does not exceed 40-horse power. Since the installation has been started, I have taken out further patents for this class of conveyor which greatly simplify the arrangement, and reduce the number of working parts. The cardinal points of a conveyor for handling gritty materials are: The employment of all steel bushed chain; overlapping carrying plates, with the supporting rollers attached thereto, and made to run on a rigid steel framework; and, finally, a large capacity at moderate speed. All these are apparent in the Saltley conveyor; and the reason of their adoption is easily explained.

[Having given this outline of examples of recent inventions, and shown how they have been successfully applied, the author indicated, by the aid of diagrams, the gradual progress made with automatic transporters, which has made possible the carrying out of various large industrial operations, which would not have been possible without the aid of the conveyor expert. He enabled his audience to follow the evolution of the screw conveyor from the time of Archimedes to the present year.]

Concrete Tanks for Gasholders.[1]

Volume 152 of the Proceedings of the Institution of Civil Engineers contains much information of value to engineers who are required to construct water-tight tanks under considerable hydrostatic pressure. The mention of the authors and subjects of three of the papers will be enough to show this. They are: "Fitzmaurice on the Nile Reservoir," "Cardew on the Burraga Dam and Water Supply," and "Delano on the Asphalt Industry." For gas engineers the subject is usually represented by gasholder tanks and similar, but smaller, receptacles for tar and ammoniacal liquor.

Lessons to be Learned.—The lessons to be learned from the general practice of civil engineers unconnected with gas works are neither few nor unimportant, and these lessons are most appreciated when a gas engineer has to design a structure to resist stresses or to meet conditions of an exceptional nature. To construct a tank in London clay, usually water-tight strata, would appear to be the problem in its simplest form. To make one wholly or partially in ground with a porous substratum of a yielding character is quite another matter. Frequently a gas engineer is called upon to erect a gasholder and tank on a site adjacent to a river and where a retaining wall is required to contain the soil, which, in turn, presses upon the tank to maintain stability. This fact reminds us that in general the walls of gasholder tanks are the medium of balancing the internal forces tending to burst and the external forces tending to crush. The disparity between these two must be supplied by the weight and tenacity of the wall, which must also be made of such a thickness as to preserve stability whilst the tank is empty, and in other ways meet the exigencies of construction and the practical considerations that have to be added to mathematical stability. Where, however, one portion of the circumference is not supported by earth pressure, then the lack must be met by an increased thickness of wall, which in the case of contiguity to a retaining wall would probably mean the union of the two. Here, then, are conditions which require that the wall shall possess within itself sufficient stability and water-tightness, and this brings the structure within the principles that govern the design of masonry dams. Of late years the practice has grown very considerably of making water works reservoirs with dams that may be termed monolithic—a superior form of concrete.

It is true that where good clay is obtainable and where the height of the embankment is not excessive, reservoirs continue to be made of earthwork, but where the conditions are otherwise the materials at hand are used to construct a masonry dam. A splendid example is the one at the Liverpool water works, at Vyrnyw in North Wales. There are many others in America, India and other parts of the world which have afforded a mixed experience, and have taught lessons from success and from failure.

Problems in Concrete Walls.—To economize material, it is usual to make the inner face of a masonry dam slope inwards, whilst, of course, by far the greatest slope is in the outward face. The reason for this is that the water pressure being normal to the surface, the vertical component becomes added to the weight of the masonry and assists in resisting the overturning moment of the horizontal component. This implies that the cross section must be designed to be in equilibrium for the reservoir both full and empty. The value of the inner slope is manifestly greatest in deep reservoirs; and in others of moderate dimensions it is often, for simplicity of building, omitted, and the inner face made vertical. This would, of necessity, be the case for a gasholder tank.

Besides stability, however, the engineer has to provide water tightness, which may be the more difficult of the two problems. In the earthwork dam the puddle trench provides this feature, whilst in the masonry dam the cement which forms the matrix is usually credited with this quality. Unfortunately, under certain conditions it fails in this respect, and remedies have to be found to counteract the evil. Much may be done by making the concrete compact, and free from

1. The *Gas World*.

voids, thus minimizing porosity, but after this has been done, with a wall having a cross section of ample strength to resist the water pressure, cracks frequently make their appearance in the finished work. No doubt the low elasticity of concrete is the main cause, and to mitigate this an engineer will sometimes design the wall to be curved in plan, when he would otherwise have made it straight. After doing this, he is not quite sure that his work will be free from cracks, and especially so where the thickness of the wall allows it to respond to the extreme changes of temperature. At a certain distance within there may be concrete that has not changed its temperature, and consequently has no tendency to crack, whilst the surface shows openings that become greater or less according to the temperature which prevails. The bearing of these observations upon the construction of an ordinary concrete gasholder tank wholly below ground level is obvious, and shows that in two respects it is a favorable case for this mode of construction. It is circular, and after being filled with water is not usually subjected to great changes of temperature. Usually, however, the walls are relatively thin, and therefore liable to yield to the stress set up by expansion and contraction, if the changes of temperature between extremes should become great, a contingency which is most likely to arise about the time of first filling with water. Hence the practice, introduced in some of the larger and most modern gasholder tanks, of embedding a series of rings of wrought iron, which supplement the low tenacity of the concrete.

The Burraga Dam.—In the light of these considerations it will be possible to glean much useful information from the following particulars, abstracted from the account given by Mr. John H. Cardew, of the Burraga dam recently erected by him in New South Wales:

Design.—The greatest height of the dam is 41 feet, the width at the crest 2 feet, and at the base 25.32 feet; it is curved in plan, the inner face of the wall having a radius of 540 feet. The length measured on the curve of the crest is 425 feet. The dam is designed with a gravity section, and no reliance is placed upon any strength that may accrue on account of its curved form * * * the curve form being introduced only to minimize the effects of expansion and contraction. The limit of pressure was assumed to be 10 tons per square foot, and the density 170 pounds per cubic foot, for concrete masonry. In cross section the inner face of the dam is vertical, the outer face of the upper part being curved to a radius of 40 feet and on the lower part battered to a slope of 1 horizontal to 1½ vertical.

Construction.—The concrete was laid in courses 2 feet in depth, extending from one end of the dam to the other, and was of two qualities, the inner face, for a thickness of 18 inches, consisting of 1 cement, 2½ sand and 3½ stone, broken to pass through a ½-inch diameter ring; and the outer face of 6 inches of 1 cement, 3 sand and 5 stone, broken to pass through a 1½-inch diameter ring. The heart of the dam was built of blocks of stone set in concrete, each stone being 6 inches from its neighbor, and none protruding into the outer or inner faces or within 2 feet of the foundation; the stones were from 2½ to 16 cubic feet, and were roughly squared, and placed with their longest dimension at right angles to the axis of the dam. The proportion of these "plums" was 33 per cent. of the whole wall. They were of diorite (specific gravity 2.60), and the concrete was of specific gravity 2.724. The sand used was of a very coarse character and quite unsuitable for making a water tight dam, but the admixture of dust from the stone breaker greatly improved the concrete in that respect. Still, despite every precaution, it was found that water came through as from a very fine rose. It was, therefore, decided to paint the inner face with neat cement mixed to a slurry, applied with stiff brushes, and well rubbed into the pores in three successive coats. This proved most effective, making the wall perfectly water tight.

Precaution.—In Australia, where hot days and cold nights give a range of temperature of 90° F., many of the concrete dams are, as a consequence, badly cracked. Curved dams are not altogether immune, the cracks occurring generally at about one-third of the length from the wings, commencing at the crest as a very fine crack, and afterwards opening out and extending down the wall a distance of one-third or one-half of its height, and opening and closing as the reservoir empties or fills. The thinner part of the dam is where the cracks invariably originate, and it was thought that the introduction of an iron tie-bar in the crest of the dam, to take the tensile stress due to the expansion, would completely preserve the dam from cracking. It was calculated that two 70-pound rails would be sufficient, but in order to have a margin of safety three 70-pound rails (double headed) were laid 6 inches below the surface, and were jointed with fish plates and bolts.

Painting versus Rendering.—Many more details are given in Mr. Cardew's useful paper, but sufficient has been quoted to show its value. Other engineers' experience confirms the testimony given as to the marked superiority of painting the surface of concrete with a slurry, over rendering with the usual coating of ½-inch thick. The cause of this superiority is that by the latter method it is impossible to obtain a perfect tie to the original concrete, and even if that be secured the differing proportions of cement and aggregate in the two cause them to behave differently under changes of temperature, and sooner or later separation occurs. In the case of brushing into the surface of the original concrete a mixture of fine sand and cement, or of neat cement, the result is the filling up of the pores and interstices without sacrifice of homogeneity.

As to the remedy for meeting contraction and expansion by inserting iron tie-bars, what strikes one in the case of the Burraga dam is the large sectional area which theory shows to be necessary. The calculated area of the cross section of the metal was 14 square inches, but 21 square inches was employed. We gather from the general description that the finished work was very satisfactory, but we are not informed that it was absolutely free from cracks. Under the severe changes of atmospheric temperature perhaps this could hardly be expected, but the facts set forth will enable this feature to receive fuller consideration in future designs of concrete gasholder tanks.

Comparison of Electric Illuminants.

By Mr. Ralph Scott.[1]

In selecting the proper lighting equipment for a factory, church, house or other building, numerous factors must be taken into account which have a more or less definite influence on the result to be attained. The following, however, are the most important, which are general in their application: A, the circuit from which the power is taken; B, nature of the space lighted; C, the light per square foot which is to be given out; D, the manner of distribution of the light, and E, the kind of light giving element use.

The last factor will be taken specifically with the other factors as they affect E.

For every 1,000-candle power given out the following watts are consumed by the various standard electric lighting devices:

Incandescent Lamps.

Volts.	Watts.
220	3,500
55	3,400
110	3,100

Nernst Lamps.

Volts.	Watts.
110	1,700
220	1,760

Inclosed Arc.

	Volts.	Amperes.	Watts.
D. C.	110	2½	615
D. C.	110	5	425
D. C.	220	3	500
Alt. C.	110	2½	450
Alt. C.	110	5	400
Alt. series			300

Open arc, 9.6 amperes; 220 watts.

The above shows that the open arc is by far the most economical in watt consumption. However, this does not include the cost of the carbons and the time required to renew the latter, which is, of course, an important factor to consider.

The tables give the light given off by the arc without considering that which is cut off by the globes, etc.

In Fig. 1 is shown the shape assumed by the carbons of an open arc. The light, in this case, is at a maximum at 45° from the vertical, while all the light is practically thrown from the arc through an angle of 125°. This is due to the effect of the crater which is formed on the upper carbon, and to the cone which is formed on the lower carbon. This is a great advantage in case the lamp is used for outside illumination.

Fig. 2 shows the form assumed by the carbons of the inclosed lamp after burning for some time. It will be noticed that the carbons are only slightly rounded in this case, while the arc is much longer than that of the open type. The maximum light given off in this case is approximately at an angle of 25° below the perpendicular drawn to the axis of the arc at its center. This is an advantage in most forms of indoor illumination where the light is not always required to throw directly downward.

In the inclosed lamp the arc does not remain in a central position but moves around the carbons to the points which are the shortest distance between the latter. When large carbons are used, this produces a floating shadow around the bottom of the globe; but this is not always objectionable, especially if an opal globe or globes be used.

Most opal globes show an orange red color held between the observer and some source of light. This serves the purpose of producing a more

1. *Electricity.*

Fig. 1.

Fig. 2.

uniform and softer light. When two opal globes are used (inner and outer) the effect is that of a uniformly illuminated ball, due to the equalizing effect of the globe on the shadows and lights produced.

The advantages of the inclosed arc over the open arc, even light, low trimming expenses and simplicity of construction of the moving system.

The matter of the selection of the globes is a very important consideration in connection with the arc lamps. When using ordinary colorless globes, 10 per cent. of the light given off by the arc is cut off. With frosted or ground glass this is increased to 25 or 30 per cent., while when deep ground glass is used, 50 per cent. of the light is cut off, which increases to 60 per cent. when using opalescent globes.

Fig. 3 shows the curves which give the direction of greatest light

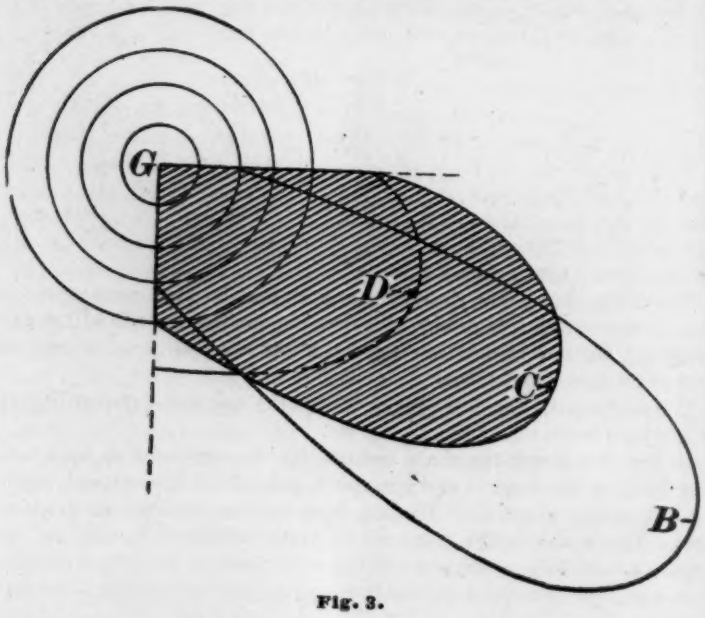

Fig. 3.

and the intensity of the light in any given direction by using various arrangements of the globes. The shaded area, curve *C*, gives the light given off by using a single opal inner or outer globe, which arrangement is to be recommended for most purposes, as a softer and more evenly distributed light is given off than is the case when using a clear globe. In this diagram the approximate amount and direction of the light is shown by supposing the arc to be at *G* and the radii of circles to represent the amount of light given out by this arc. These curves show only the light given off below the horizontal line supposed to be drawn through axis of the arc. Curve *B* represents the light given off when a clear outer and inner globe is used, *C* when one of these globes is opal as above stated, and *D* where both are opal. The arrangement which produces curve *C* is most useful for indoor illumidation, while *B* is best adapted for outdoor illumination. Where a soft, evenly distributed light is required, as would be the case in a church or library, the arrangement producing curve *D* is to be recommended.

In point of economy of watt consumption, the Nernst lamp is intermediate between the incandescent and arc. Where a soft, even and shadowless light is required, the Nernst is at present the most perfect light which has been produced. The principal field of this lamp is in the lighting of libraries, churches, houses and stores. As yet it has not invaded outdoor or factory illumination to any great extent. This is principally due to its high initial cost as compared to the arc and incandescent lamp.

Fig. 4 shows a good arrangement for lighting a factory or other simi-

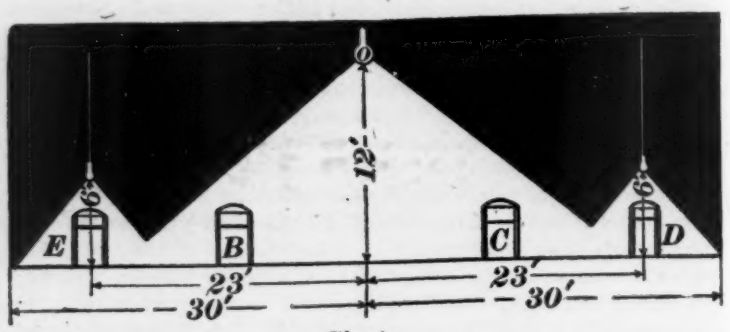

Fig. 4.

lar buildings. The building in this case is supposed to be about 60 feet wide and of any length. Arc lamps are arranged in a row in the center of this building; these arcs being from 30 to 100 feet apart, according to the illumination desired. Arranged in rows 23 feet from the arcs are incandescent or Nernst lamps, these being spaced from 15 to 30 feet apart, according to the intensity of the lighting required, although where there are rows of machines or tables, *D* and *E*, more may be required, or each individual machine may be provided with lamps. This figure represents a sketch of an actual case which is remarkable for the even illumination which results.

Most buildings are lighted either by arc lamps or incandescent lamps exclusively. This is a poor practice, especially where the latter arrangement is used. In lighting up any inclosed area, the arc or incandescent should not be placed anywhere where convenience dictates, but should be so symmetrically arranged that the light is distributed evenly over the area lighted.

Opaque shades should be provided with incandescent lamps in factories, so that most of the light will be reflected downwards, as it is generally required that the light fall on certain machines or tables. On the other hand, in lighting houses and churches the shades should be translucent so that the light will not only be reflected downward but in all other directions as well.

The colors of the walls of a room have a certain effect on the number of lamps required to produce a certain lighting effect. Dark walls only reflect from 15 to 20 per cent. of the light which is thrown upon them, while a perfectly clean white surface will reflect from 80 to 90 per cent.

In an ordinary building, when one incandescent lamp (16-candle power) is used for every 100 square feet of floor area, the effect is dull. When two lamps are used a good reading light is produced; when three lamps are used the effect is very bright, while when four lamps are used the effect is brilliant.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Mr. John F. Kerrigan, a prominent resident of Hiawatha, Kan., writing under date of the 27th ult., in subscribing to the Journal says: "Parties here are about to install a gas plant. The town is one of 4,000 population, and were you to give us the names of some half dozen installing companies with which we could correspond it would be a great favor. We think we want an efficient gas plant of suitable capacity for our town."

Mr. J. A. Mayers, of this city, writing to the Journal under date of the 28th ult., says: "To the Editors American Gas Light Journal: Many explosions have occurred from the application of a light to a jet from apparatus and mains during the operation of purging them from air and filling them with gas to determine if they have been freed from the first named. Many more explosions would have occurred had the light been applied at a less favorable moment. This risk can be entirely avoided by a simple and absolutely safe experiment performed by the aid of articles in daily use. Thus: Half fill a bucket with water, attach a section of gas hose to jet coupled to a cock, from the main or apparatus to be purged. Open the cock, allowing the mixture of air and gas to pass through the hose for a few seconds; submerge an ordinary drinking glass in the water, filling it with the latter, and turn it upside down holding it by the bottom, keeping its mouth under water. Place the end of the hose in the water under the glass, and in a few seconds the water in the glass will be displaced by the gaseous mixture. Close the cock and raise the glass completely out of the water, still holding it upside down. Now, to this sample of the mixture apply a

light. If it burns with a white flame, it is all gas; if with a blue flame it is still mixed with air; if it explodes you have saved a works from an explosion of unknown consequences."

In our advertising columns will be found an announcement respecting the acquisition, by the Semet-Solvay Company, of Syracuse, N. Y., of the properties and rights and business of the United Coke and Gas Company. We understand that the course adopted by the parties to the bargain was brought about by the very close margins on which this particular business has been conducted of late, and the growing number of plants, with the resultant increase of by-products, involving their preparation into salable forms. "The development of this form of oven has shown," according to one high in the affairs of the amalgamated concern, "that it is a highly specialized matter, involving many chemical and engineering questions and many incidental complications, all of which can be handled much better under the union of interests now effected." The American Coal Products Company, of New York, has been appointed selling agent for the tar and ammonia from both systems of ovens.

Messrs. H. M. Atkinson and associates, who are in complete control of the gas, electric lighting and railway systems of Atlanta, Ga., are about to expend large sums of money in overhauling, enlarging and extending the several plants. So far the plans of betterment, as these relate to the gas division of the enterprise, call for a new retort house to hold 12 benches of 9's; an elevated coke storage bin, up to retaining 1,200 tons, the fitting to include elevators and cars to convey the coke from the basement of the retort house to the new receptacle; a new boiler of 400-horse power, and a house for same; new exhausters, scrubbers, condensers, washers, etc. The equipment also includes an oil storage tank with a capacity for holding 100,000 gallons. From this it will be seen that Superintendent Crowell has quite some work cut out for him this winter; but that he will get through with it all right is a certainty. It is worthy of note that 45 per cent. of the output of the Atlanta Gas Light Company is on fuel account, and that over 9,000 gas stoves are in use in that progressive Southern city.

A correspondent in Michigan City, Ind., forwards the following, under date of the 27th ult.: "The Oklahoma City Gas Light and Fuel Company was formed in this city some days ago by a number of Michigan City capitalists, who propose to construct a gas plant in the capital city of Oklahoma. The gentlemen interested in the Company are Messrs. W. B. Hutchinson, J. E. DeWolfe, Philip Zorn, John Pitsch, W. H. Schoenemann, A. J. Henry, S. W. Larsen, William Miller, Herman Brinckmann and A. A. Boyd. Associated with them will be several moneyed men of Oklahoma City. The Corporation was formed at a meeting held at the Citizens Bank, and the following Directors were elected: Philip Zorn, John Pitsch, A. A. Boyd, J. E. DeWolfe and W. H. Schoenemann. Two stockholders from Oklahoma will be added to the Board, making a Directory of 7 members. The Company has been capitalized at $150,000 and will at once proceed in the erection of a plant. Already a mile and a-half of pipe is in the ground, and the entire city is to be piped during the winter. The projectors of the Company have inspected the ground thoroughly and are confident that they have a good thing. Their franchise is a very liberal one and nothing stands in the way of immediate activity in construction."

The capacity of the Pintsch plant at Ogden, Utah, is to be doubled. Say what one may, the Pintsch light is the best, most available and most economical for long distance train travelling lighting now extant.

The Massachusetts Board of Gas and Electric Lighting Commissioners has under consideration the following petitions: The Adams Gas Light Company, to increase its capital stock from $17,300 to $50,000; the Williamstown Gas Light Company, from $20,000 to $40,000; and the North Adams Gas Light Company from $100,000 to $200,000. The Colonel is evidently "finishing up."

The Sparrows' Point, Maryland, coke ovens are reported in successful operation.

A fire that occurred the morning of the 27th ult. did much damage to the main electric station, at Hackensack, of the Bergen County Gas and Electric Company, Hackensack, N. J.

Clause 7, of the enabling act of the Company which proposes to supply gas in Juneau, Wis., is as follows: "Each consumer shall pay for the use of gas the sum of $1.50 per 1,000 cubic feet, provided that each consumer shall pay a minimum rate of 25 cents per month whether gas be used or not; all gas rents shall be payable monthly on the first day of each month, or as soon thereafter as the Superintendent shall have ascertained the amount of gas consumed. If the amount is not paid within 24 hours after the receipt of the statement rendered by the Superintendent, a penalty of 10 per cent. shall be added, and if the same, together with the penalty, shall not be paid within 58 hours thereafter, the gas shall be shut off from the premises."

A dividend of 3 per cent. on the preferred stock of the Columbus (O.) Gas Light and Heating Company has been declared. It is payable on and after the 15th inst.

The New England Gas and Coke Company, of Everett, Mass., is no longer supplying gas to the Boston, South Boston and Roxbury Gas Light Companies.

The Plymouth (Mass.) Gas Light Company is planning for notable main extensions.

The proprietors of the Mutual Gas Light Company, of Savannah, Ga., have applied for an amendment to their charter, permitting an issue of bonds, not to exceed $1,800,000, and the Savannah Gas Light Company would ask permission "To sell whatever part of its property it sees fit."

The plant of the Elgin American Gas Company, at Elgin, Ills., will be rebuilt next season.

Mr. James Trimble, formerly connected with the Hammond (Ind.) Illuminating Company, has been appointed Superintendent of the Rapid City (So. Dak.) Gas Light Company.

Mr. James H. Dodge has been appointed Superintendent of the Belfast (Me.) Gas and Electric Company.

Mr. A. W. Young, Superintendent of the Knoxville (Tenn.) Gas Light Company, has the satisfaction of knowing that his plans for the enlargement of that plant have been approved. The work will be undertaken next spring, and the estimates involve an expenditure of $100,000.

Kansas City, Mo., has decided that the wages of the third assistant gas inspector for that city shall remain at $75 per month. The "inspector" asked for $90 per month. An ordinance putting the "thirds" out of business would be more towards the fair point.

The proprietors of the Joliet (Ills.) Gas Light Company have purchased 15 acres of ground at an eligible point near the city, whereon it is proposed eventually to construct a plant suitable for the gas supply of the boroughs of Plainfield, Aurora, Batavia, Geneva, St. Charles, Grossdale, La Grange, Hinsdale, Western Springs and Downers' Grove.

Mr. Howard Bixby, of Chambersburg, Pa., has been appointed Superintendent of the Union Gas and Electric Company, of Bloomington, Ills.

The following "Wail" is from a recent issue of the Hamilton (O.) *Democrat:* "About as melancholy an example as was ever witnessed in any city is now being furnished to the people of Hamilton in the matter of gas. It was only a few years ago that the people made a desperate struggle to be free from what was called the 'Old Gas Company,' and by their votes went into the gas making business. This was all right and it is regrettable that the city's gas business could not have been placed in the hands of men who would have managed it economically and with vim. The past few years have seen the city's gas plant go backward and backward. The management of the plant had under the old Board of Control was little less than criminal. The members of the Board of Control were governed solely by politics in the conduct of the gas works; a superintendent was hired who was not competent for the place, but he was kept in position all the same. The gas plant went from bad to worse, and to-day the spectacle that is present in this—the city asking its old enemy, 'The Old Gas Company' to help it out. To the credit of 'The Old Gas Company' let it be said that it has responded in noble manner. Instead of being vindictive the city's appeal is given consideration and gas is offered to the city's plant that it may be kept going and that it may supply its customers. If any man would have said the city's gas plant would have ever come to this he would have been ridiculed down, but the hard facts stare the people of Hamilton in the face. The electric light plant is in no better condition to do business and make money than the gas plant and our magnificent water works system has been and is on the down grade."

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

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WESTERN GAS ASSOCIATION.
OHIO GAS LIGHT ASSOCIATION.

NOTIFICATION RESPECTING ADVERTISING.

Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:

New York—American News Co., 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, DECEMBER 7, 1903.

The Market for Gas Securities.

The trading in Consolidated was much in excess for the past week over that recorded for some time back, and the bulk of it was done at figures showing successive gains. The closing to-day (Friday) was reported at 179½ to 180. A considerable short interest yet remains to be covered, and before a settlement of it all is reached Consolidated should sell at least 10 points higher than the figures of to-day. There is some inquiry for Standard, both common and preferred, but actual sales are not much in evidence.

Brooklyn Union is dull and strong, the nominal figures for it being 190 to 210. Our belief is that this stock offers the best opportunity of anything on the whole list for a good turn.

Peoples, of Chicago, steadily gains; 96¼ was the bid closing price this afternoon. It is steadily absorbed by investors who seldom make mistakes in their purchases. Laclede preferred is 88 bid. The regular dividend of 2½ per cent. on the preferred is payable the 15th inst.

Baltimore Consolidated shows some improvement, and Cincinnati Gas and Electric is reported at 96½ to 97.

More than rumor would indicate that important changes in the ownership of the Hartford City (Conn.) Gas Light Company are about to take place. It is likely that a well-known New York operating firm will get that fine property.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

DECEMBER 7.

☞All communications will receive particular attention.

☞The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	179⅛	180
Central Union, Bonds, 5's.	3,000,000	1,000	104	106
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	118	120
Metropolitan	658,000	..	108	112
Mutual	3,500,000	100	260	300
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co. .. Bonds, 5's	11,000,000	1,000	103	105
Northern Union, Bonds, 5's.	1,250,000	1,000	105	106⅛
New York and East River Bonds 1st 5's	3,500,000	1,000	102	106
" 1st Con. 5's	1,500,000	..	109	111
Standard	5,000,000	100	135	140
Preferred	5,000,000	100	155	170
Bonds, 1st Mortgage, 5's	1,500,000	1,000	116	117
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	190	210
" " Bonds (5's)	15 000,000	1,000	119	119¼
Bay State	50,000,000	50	⅛	¼
" Income Bonds	2,000,000	1,000	.	75
Binghamton Gas Works	450,000	100	28	30
" 1st Mtg. 5's	500,000	1,000	93	96
Boston United Gas Co.— 1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	4	5
" " Bonds, 5's	5,250,000	1,000	73	76
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati Gas & Elec. Co..	29,500,000	100	96½	97
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	101	101½
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	88¾	89¼
Preferred	3,026,500	100	107½	109
Consumers, Jersey City Bonds	600,000	1,000	100	102
Consumers, Toronto	1,700,000	50	218	225
Consolidated, Baltimore	11,000,000	100	60¾	61
Mortgage, 6's	3,600,000	..	..	115
Chesapeake, 1st 6's.	1,000,000	..	..	..
Equitable, 1st 6's.	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	15	17
" Con. Mtg. 5's	880,000	1,000	86	90
Consolidated G. & E. Co.'s. Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co	4,825,500	50	87	95
" Prior Lien 5's	5,603,000	1,000	99⅛	100
Detroit Gas Co., 5's	361,000	1,000	77	79
" Inc. 5's	16,000	100	98⅛	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	35	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104⅛	105
Hartford	750,000	25	245	265
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	101	103
Indianapolis	2,000,000	..	50	65
" Bonds, 6's	2,650,000	..	103⅛	106⅛
Jackson Gas Co	250,000	50	73	75
" 1st Mtg. 5's	290,000	1,000	101	103⅛
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	79	90
Preferred	2,500,000	100	88	..
Bonds	10,000,000	1,000	109¼	110
Lafayette Gas Co., Ind.	1,000,000	100	.	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	136	140
Madison Gas & Elec. Co. " 1st Mtg. 6's	350,000	1,000	107½	108¼
" 6 per cent. scrip, due 1910	100,000	25	85	87
Montreal, Canada	2,000,000	100	218	184¾
Nashville Gas Lt. Co.	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	4,600,000	..	105	105¾
New Haven	1,000,000	25	260	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	96¼	96¾
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
" 2d "	2,500,000	1,000	104	..
Rochester Gas & Elec. Co..	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	15 800,000	100	67	67¼
St. Joseph Gas Co. " 1st Mtg. 5's	751,000	1,000	92	96½
St. Paul Gas Light Co	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's	2,465,000	1,000	92	93
Syracuse, N. Y.	1,975,000	100	46	48
Bonds	2,047.000	1,000	94	96
Washington, D. C	2,600,000	20	283¾	288¼
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	.	..	..
Wilmington, Del	600.000	50	232	..

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(*Continued on page* 896.)

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As Manager or Superintendent of a Water Gas Plant,

By a man 44 years old. Has made good showing in developing new business. Is at present with plant putting out 350,000,000 yearly. Address, "A. B.,"
1484-tf Care this Journal.

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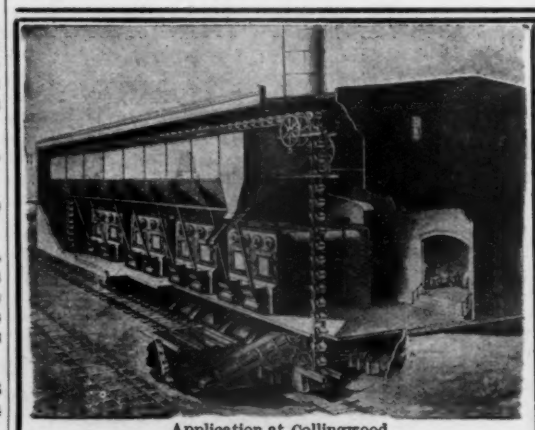

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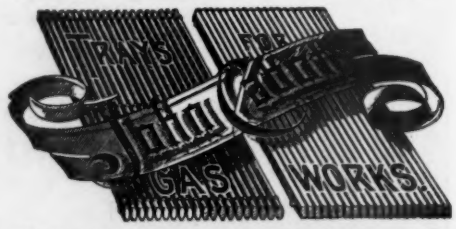

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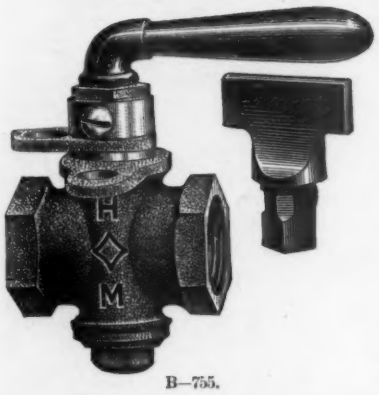

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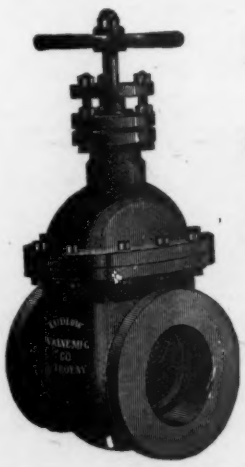

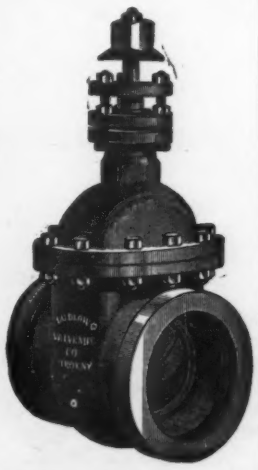

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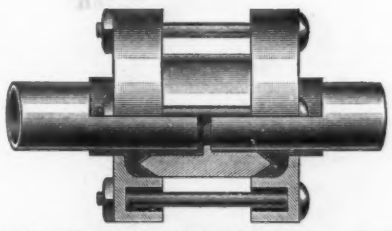

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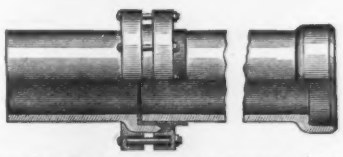

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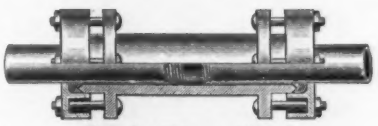

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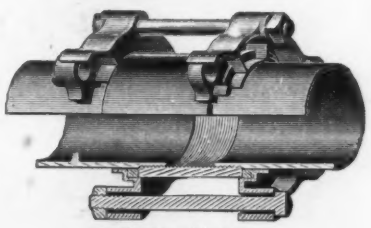

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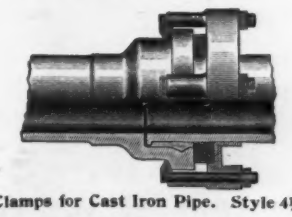

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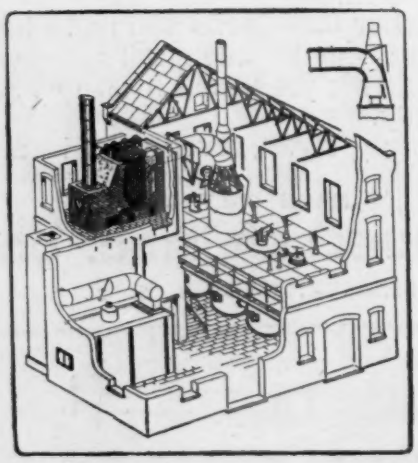

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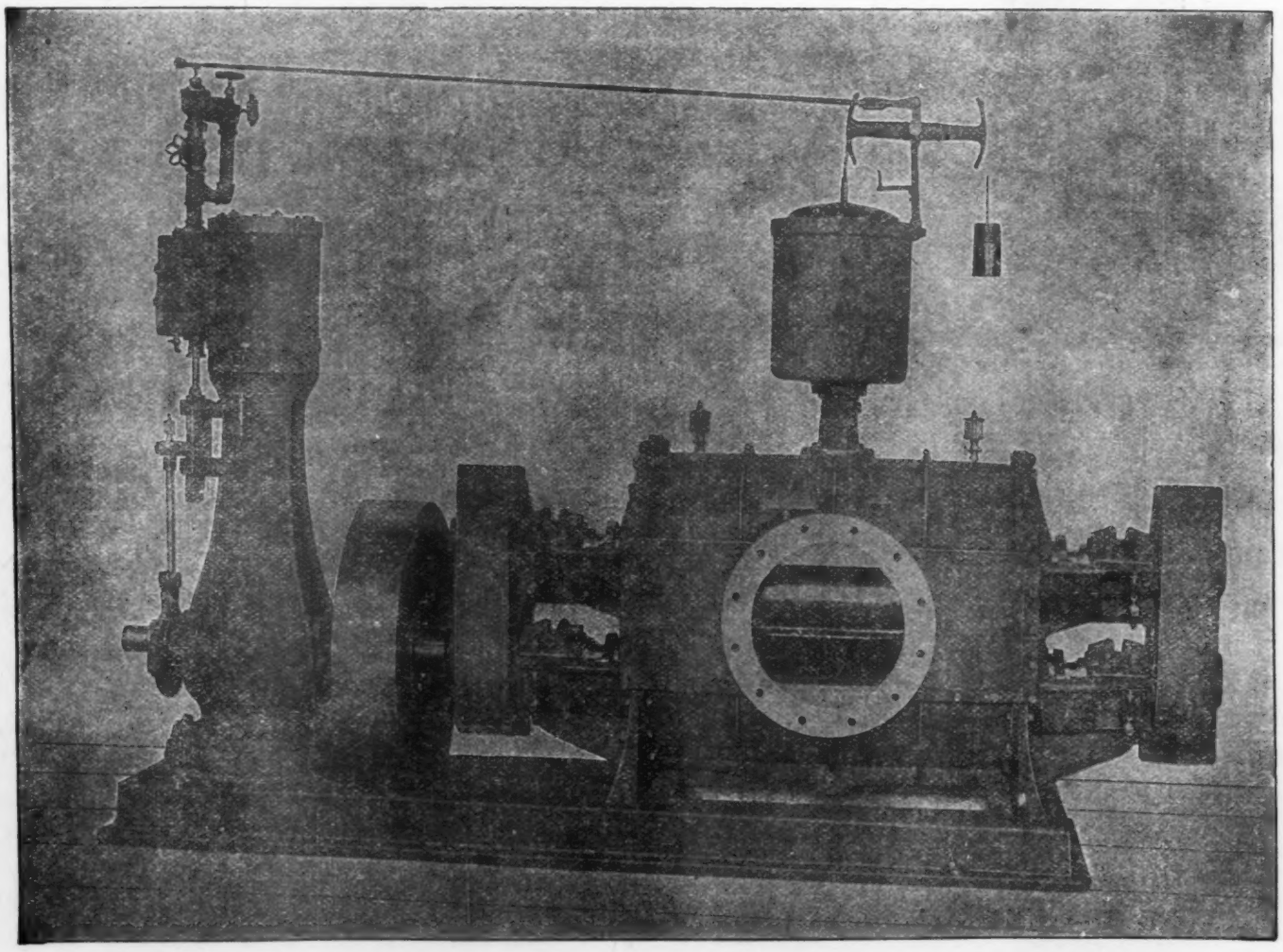

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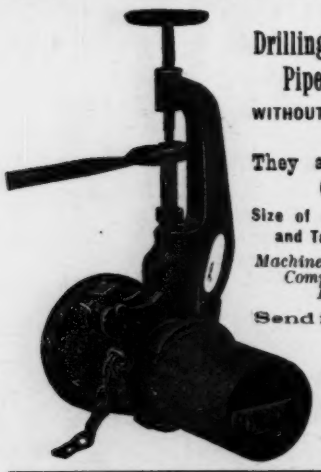

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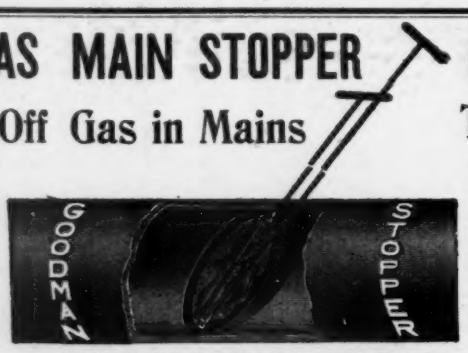
Temporarily during alterations and repairs. : : : :

Any size gas main can be shut off in 30 seconds. : : :



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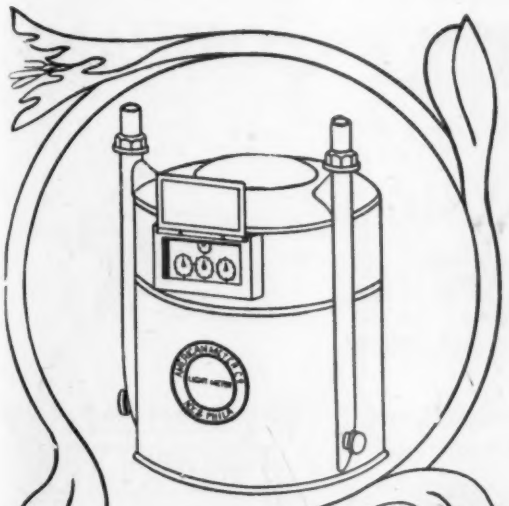
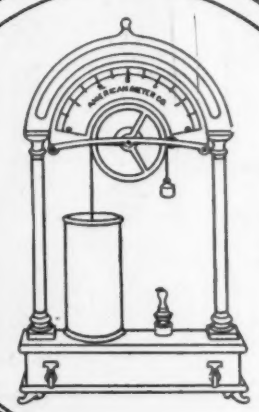
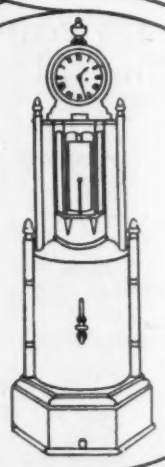






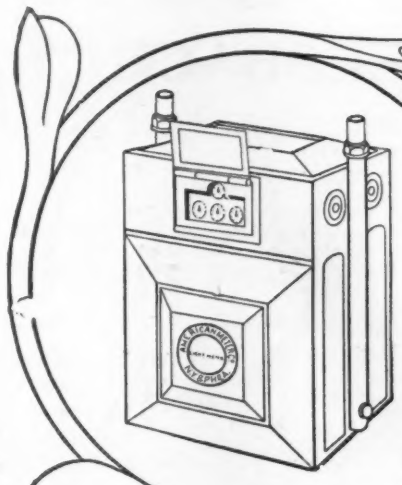
PUBLIC LIGHTING TABLE.

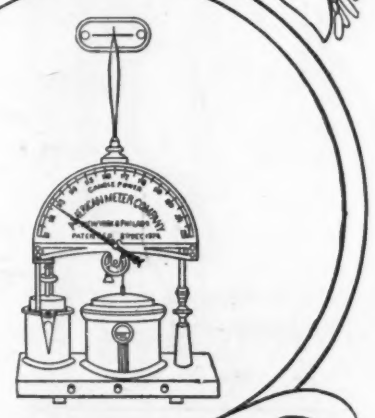
DECEMBER, 1903.

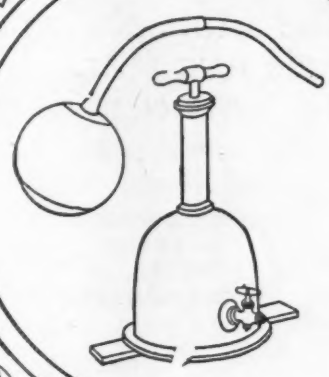
Day of Week.	Date.	Table No. 1. FOLLOWING THE MOON. Light.	Extinguish.	Table No. 2. NEW YORK CITY. ALL NIGHT LIGHTING. Light.	Extinguish.
				P.M.	A.M.
Tue.	1	3.30 AM	6.00 AM	4.20	6.10
Wed.	2	4.30	6.00	4.20	6.10
Thu.	3	No L.	No L.	4.20	6.15
Fri.	4	No L. FM	No L.	4.20	6.15
Sat.	5	No L.	No L.	4.20	6.15
Sun.	6	5.00 PM	8.00 PM	4.20	6.15
Mon.	7	5.00	9.00	4.20	6.15
Tue.	8	5.00	10.10	4.20	6.15
Wed.	9	5.00	11.20	4.20	6.15
Thu.	10	5.00 LQ	12.30 AM	4.20	6.20
Fri.	11	5.00	1.40	4.20	6.20
Sat.	12	5.00	2.40	4.20	6.20
Sun.	13	5.00	3.40	4.20	6.20
Mon.	14	5.00	4.50	4.20	6.20
Tue.	15	5.00	6.20	4.20	6.20
Wed.	16	5.00	6.20	4.20	6.20
Thu.	17	5.00	6.20	4.20	6.20
Fri.	18	5.00 NM	6.20	4.20	6.20
Sat.	19	5.00	6.20	4.20	6.20
Sun.	20	5.10	6.20	4.20	6.20
Mon.	21	5.10	6.20	4.20	6.20
Tue.	22	5.10	6.20	4.20	6.20
Wed.	23	8.20	6.20	4.20	6.20
Thu.	24	9.10	6.20	4.20	6.25
Fri.	25	10.10	6.20	4.20	6.25
Sat.	26	11.10 FQ	6.20	4.20	6.25
Sun.	27	12.10 AM	6.20	4.20	6.25
Mon.	28	1.10	6.20	4.20	6.25
Tue.	29	2.10	6.20	4.20	6.25
Wed.	30	3.10	6.20	4.20	6.25
Thu.	31	4.20	6.20	4.20	6.25

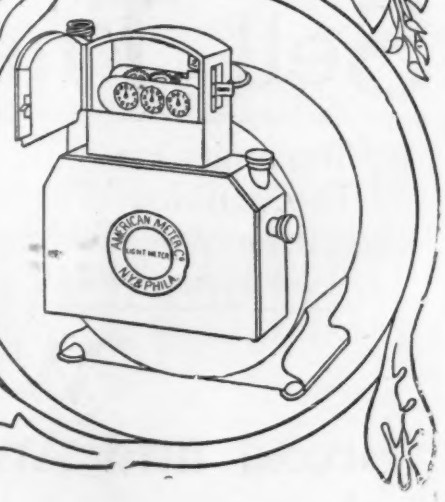
TOTAL HOURS LIGHTING DURING 1903.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	245.00	January	423.20
February	192.00	February	355.25
March	201.00	March	355.35
April	167.20	April	298.50
May	152.00	May	264.50
June	131.00	June	234.25
July	140.40	July	243.45
August	156.20	August	280.25
September	171.20	September	321.15
October	198.20	October	374.30
November	216.30	November	401.40
December	232.10	December	433.45
Total, yr.	2203.40	Total, yr.	3987.45





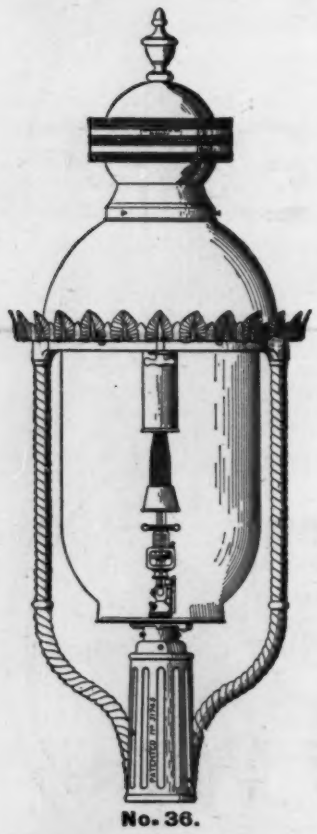




NEW YORK, 33 Nassau Street. PHILADELPHIA, Broad and Arch Streets. CHICAGO, Foot of Orleans Street. BOSTON, 814 Beacon Building.
CLEVELAND, 809 Cuyahoga Building. ST. LOUIS, 712 Roe Building. SAN FRANCISCO, 712 Polk Street.

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....



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Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

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By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

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IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

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No. 38.

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The imitation stuff is bad for the customer---which is bad for you.

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THE UNITED GAS IMPROVEMENT COMPANY

For the Months Ending October 15, 1903, has been Awarded Contracts in the Following Places for

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Rochester, N. Y.	Hempstead, N. Y.	Allentown, Pa.
Baltimore, Md.	Chester, Pa.	Savannah, Ga.
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Amesbury, Mass.	Newark, N. J.	Cicero, Ills.
Aberdeen, S. D.	Washington, D. C.	Chicago (Ogden Co.)
Winsted, Conn.	Boone, Ia.	Easton, Pa.
Canon City, Col.	Pueblo, Col.	Lawrence, Mass.
Schenectady, N. Y.	Charlotte, N. C.	Council Bluffs, Ia.
Hagerstown, Pa.	Fall River, Mass.	Chattanooga, Tenn.
Malden, Mass.	Duluth, Minn.	Tuckerton, N. J.
Bridgeport, Conn.	New York (Mutual Co.)	Springfield, O.
Albert Lea, Minn.	Waltham, Mass.	Easton, Pa. (2d contract).
Brooklyn, N. Y.	Dover, Del.	Mobile, Ala.

TOTAL DAILY SETS TO OCTOBER 15, 1903, ... 55
TOTAL DAILY CAPACITY, ... 56,600,000 cubic feet.
TOTAL SETS TO DATE, ... 502
TOTAL DAILY CAPACITY, ... 356,280,090 cubic feet.

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Broad and Arch Streets, Philadelphia.

Established 1858. Incorporated 1890.
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Manufacturers of the very best quality of Clay Retorts, Blocks, Tiles, Settings and Firebrick of every description.

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WORKS, Perth Amboy, N. J.
OFFICE, 418 to 422 East 23d St., N. Y.

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BENCH SETTINGS,
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GEROULD'S IMPROVED RETORT CEMENT

A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

Price List, f.o.b. Galesburg, Ills., or Buffalo, N. Y.
In Casks, 400 to 800 pounds, at 5 cents per pound.
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PIPING IN AND AROUND GAS WORKS.

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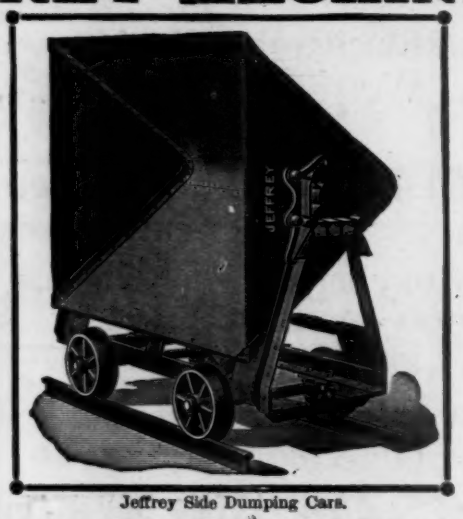

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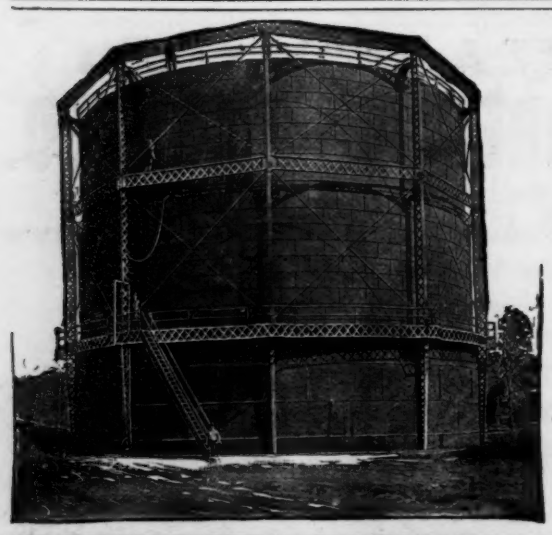

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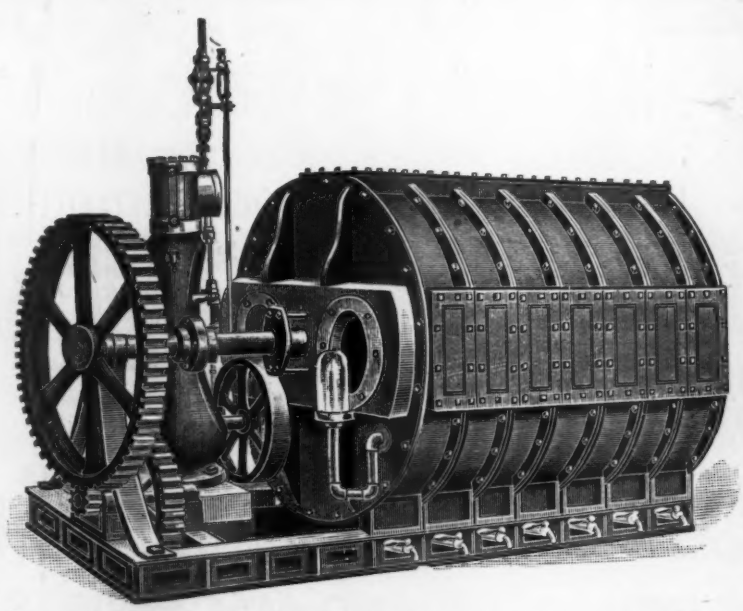

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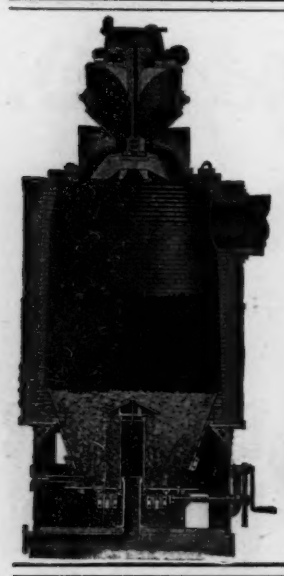

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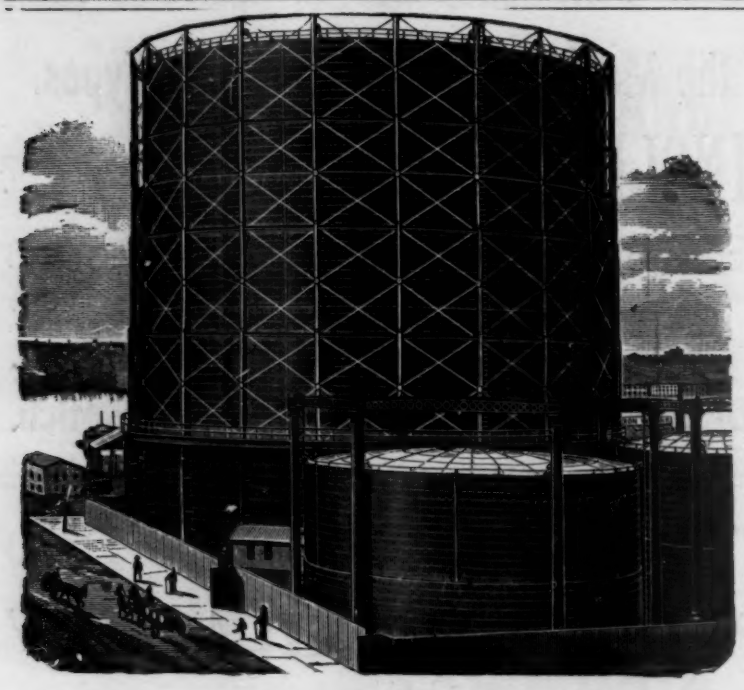

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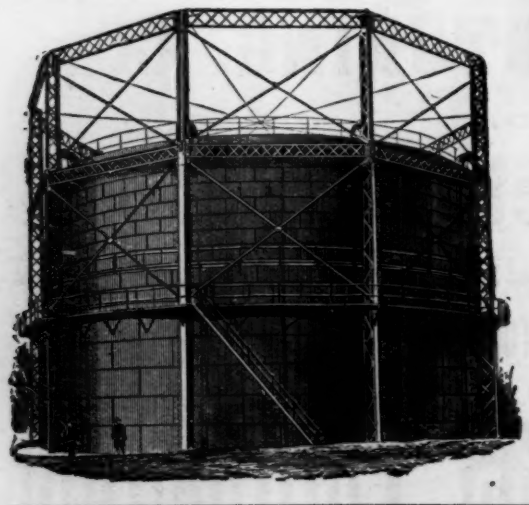

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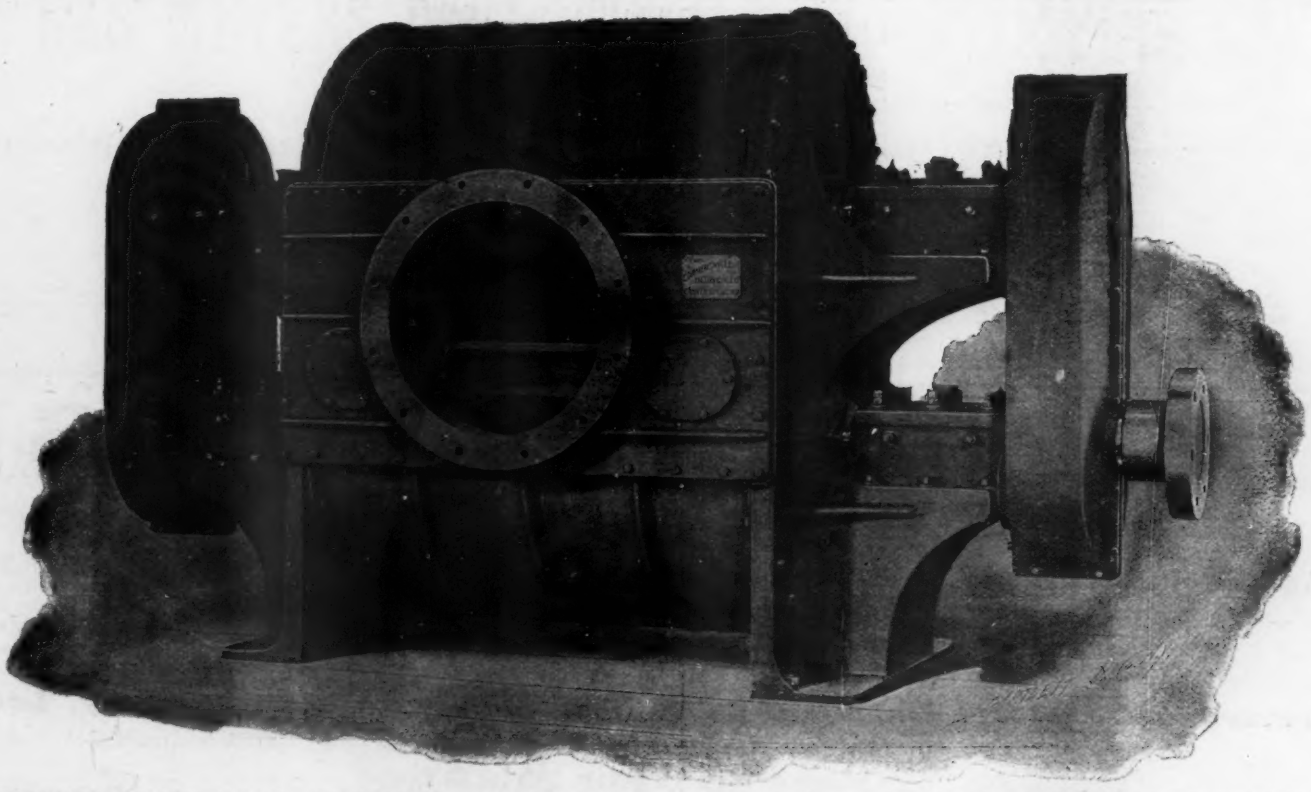

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